WIRE AND WIRE PRODUCTS

SEPTEMBER 1959

Packaged Productivity in Wire!

VAUGHN® MOTOBLOX®

VAUGHN puts everything but a bow on this package for you . . . including all electrical equipment and prewired controls. Compact, self-contained, easy to install, this packaged MOTOBLOX requires no separate room or additional space for motor generator set, starter or dc control—affords the highest speeds you can use today. Write us for the details!

The VAUGHN MACHINERY COMPANY
CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

COULTER & McKENZIE

continuous

WIRE DRAWING & PACKAGING MACHINE

MODEL 116B: PRECISION BUILT
CUSTOM ENGINEERED

SUPER FAST BLOCK CHANGES — Push button control interchanges 3 standard size draw blocks in seconds with no **gear or belt changes.** (8″, 10″ and 12″ blocks)

EXTRA VERSATILE PACKAGING — Accommodates coils, stems, and Draw-Pak containers. (20″ x 30″ or 23″ x 30″ drum)

IMPROVED DESIGN FEATURES:

1. Positive tangle switch
2. Fully enclosed
3. Liquid cooled
4. All steel welded construction
5. Electric clutch for "Soft Starting"

GREATER PRODUCTION CAPACITY

1. Continuous drawing and packaging of ferrous or non-ferrous wires
2. Wire sizes to .100″
3. Number of reductions — 3 to 12
4. Speeds to 1000 ft./min.

Model 116-B will be custom engineered to your particular job.

For information concerning your application, please write or telephone.

This equipment manufactured under one of the following U. S. Patents 2,732,060; 2,868,474; 2,844,416; 2,868,268 or others pending.

Barron & Crowther Ltd., Eastleigh Hants, England. European Draw-Pak Licensee. Idos Industries Ltd., Royston Herts, England, Sales Agents.

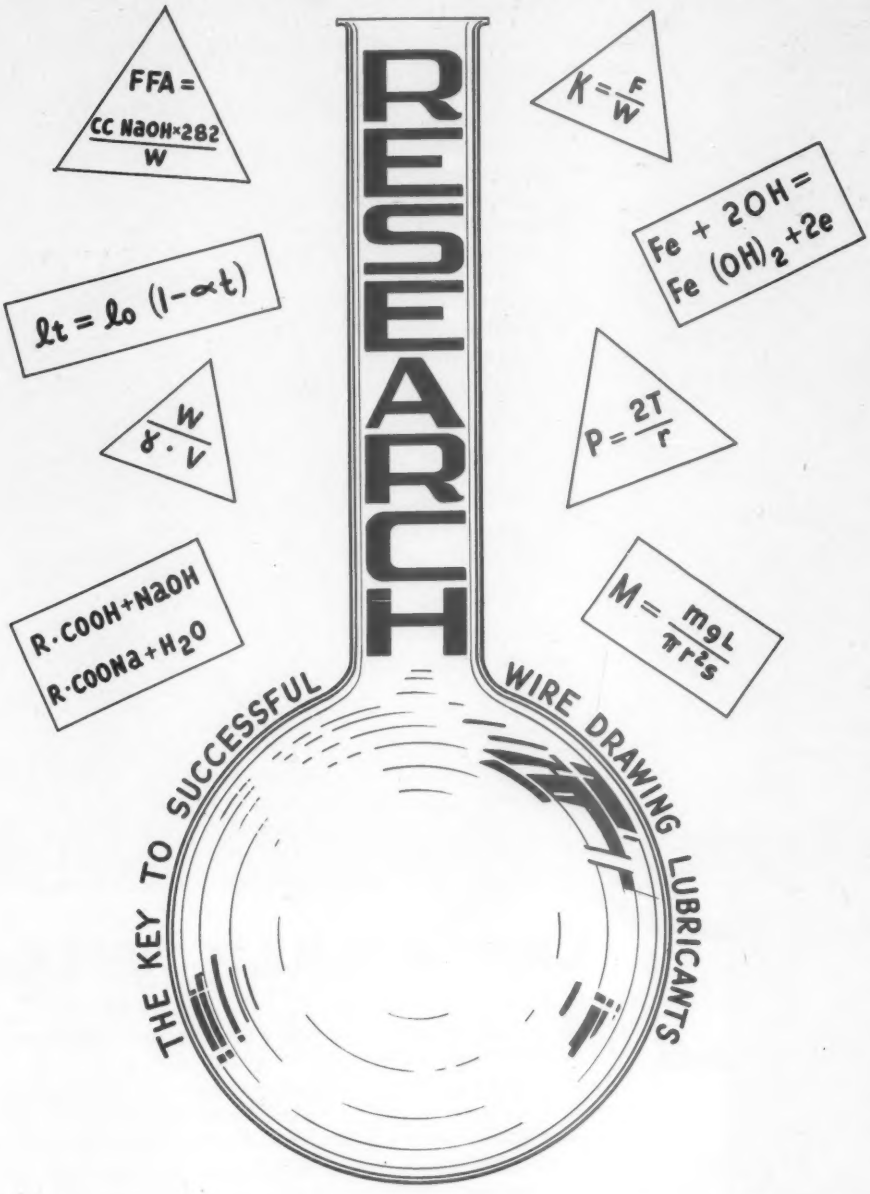
35 UNION AVENUE

TELEPHONE EDISON 5-1101
LIEBER'S CODE "MACKENZIE"

THE COULTER & McKENZIE MACHINE CO., INC.

SINCE 1843 BRIDGEPORT 7, CONNECTICUT, U.S.A. INCORPORATED 1881

"America's Finest Wire Draw"



"Look to Standard for the Future"

Cordially yours,

Standard Industrial

COMPOUNDS CO., INC.

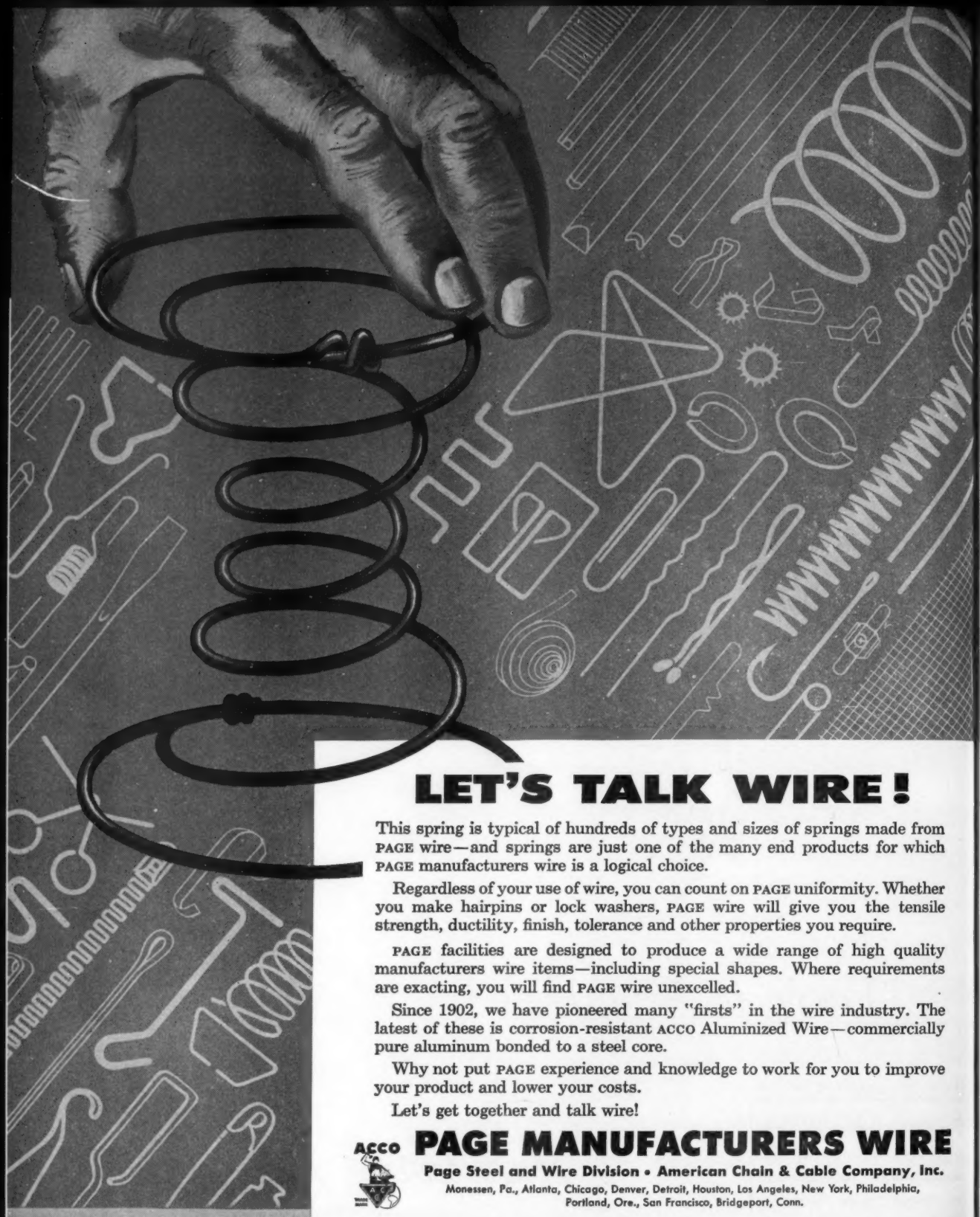
Member WAS

FRANKFORT, ILLINOIS

(A suburban Chicago area city)

Telephones: 2131 - 2141

Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.



LET'S TALK WIRE!

This spring is typical of hundreds of types and sizes of springs made from PAGE wire—and springs are just one of the many end products for which PAGE manufacturers wire is a logical choice.

Regardless of your use of wire, you can count on PAGE uniformity. Whether you make hairpins or lock washers, PAGE wire will give you the tensile strength, ductility, finish, tolerance and other properties you require.

PAGE facilities are designed to produce a wide range of high quality manufacturers wire items—including special shapes. Where requirements are exacting, you will find PAGE wire unexcelled.

Since 1902, we have pioneered many "firsts" in the wire industry. The latest of these is corrosion-resistant ACCO Aluminized Wire—commercially pure aluminum bonded to a steel core.

Why not put PAGE experience and knowledge to work for you to improve your product and lower your costs.

Let's get together and talk wire!

ACCO

PAGE MANUFACTURERS WIRE

Page Steel and Wire Division • American Chain & Cable Company, Inc.

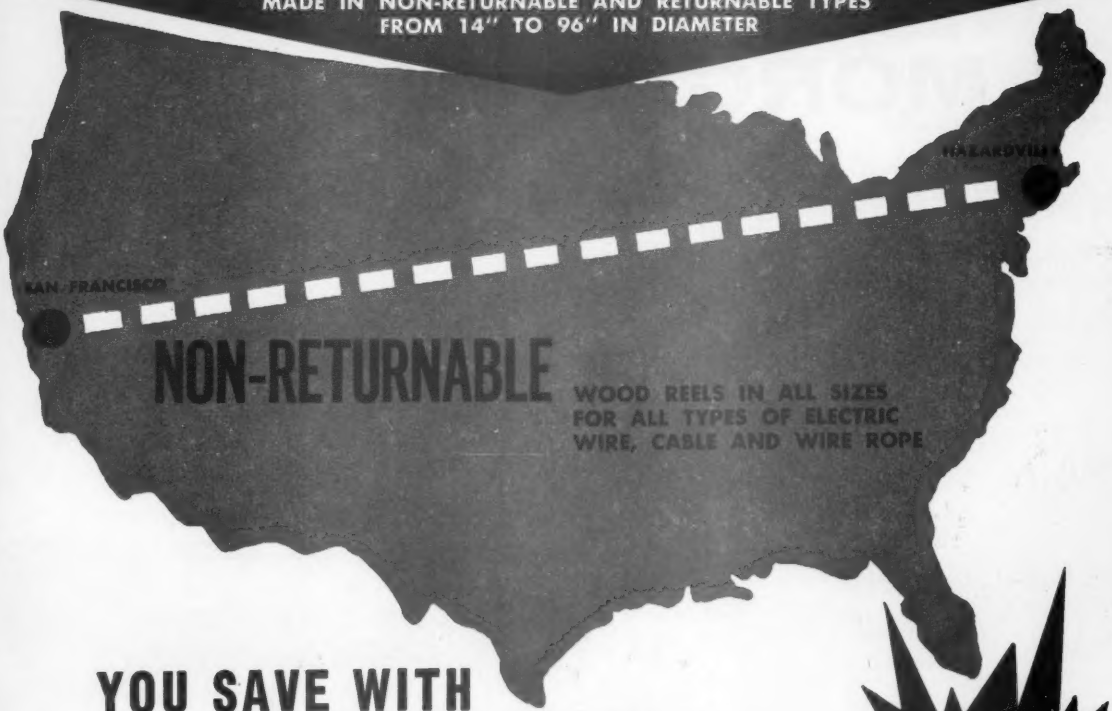
Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE *-the source for answers to wire problems*

A BOARDWALK FROM HAZARDVILLE TO SAN FRANCISCO

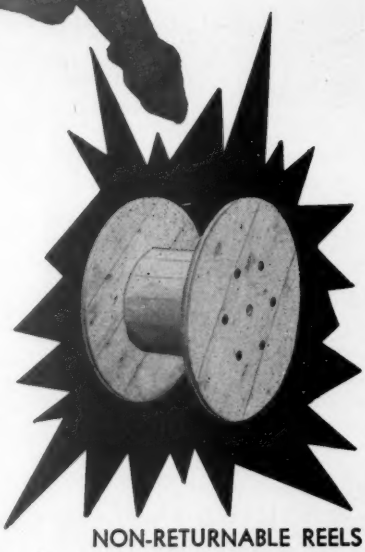
The wood used in the manufacture of BRIDGE REELS, in one average year's production, would make a boardwalk one-inch thick and twelve inches wide stretching over 3,000 miles across the country — OR — it would provide enough lumber to build 3,000 six-room houses — THAT'S QUITE AN OPERATION! The important deduction, however, is that BRIDGE REELS for WIRE, WIRE ROPE and CABLE are good enough to meet the exacting demands of most of the big wire plants of the country.

MADE IN NON-RETURNABLE AND RETURNABLE TYPES
FROM 14" TO 96" IN DIAMETER

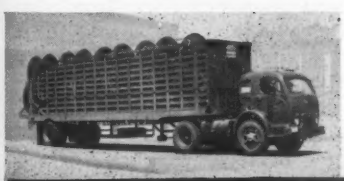


YOU SAVE WITH NON-RETURNABLES

- Reduced Reel Investment
- Less Storage Space
- Lower Freight Costs
- No Repair Costs
- No Return Freight Charges
- No Bookkeeping
- No Deposits Needed
- No More Headaches!!



NON-RETURNABLE REELS GIVE YOU A DEFINITE PACKAGING COST.



HIGH SPEED
SHIPPING SERVICE IN OUR OWN TRUCKS

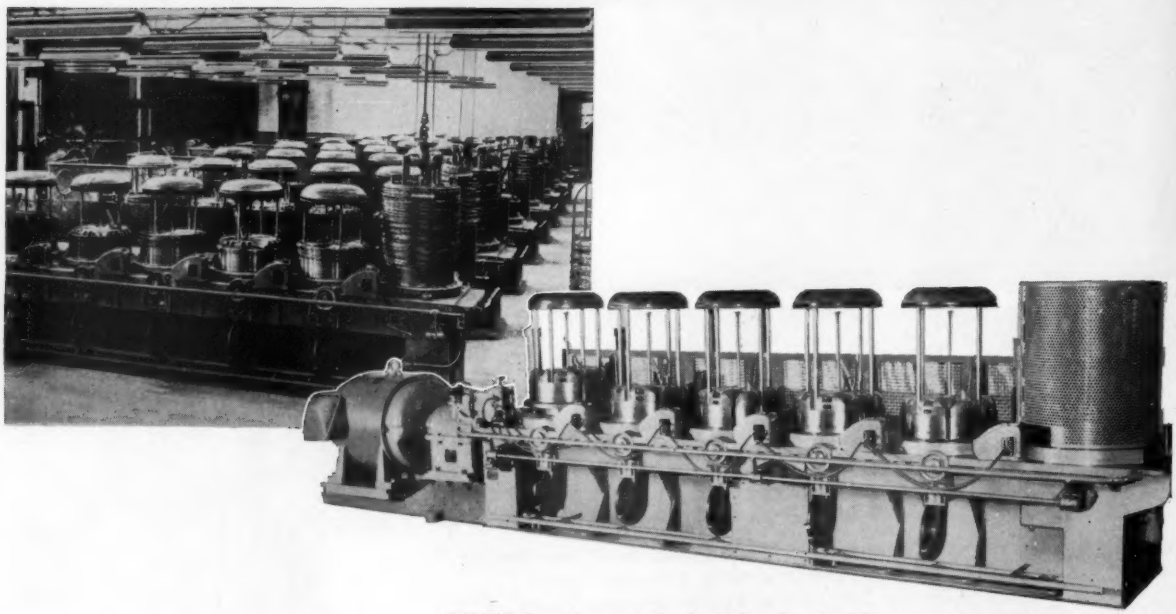
within a radius of 250 miles from the plant. Fast freight will bring you Bridge reels within a few days east of the Mississippi.

"REEL GOOD . . .

Let us quote on your reel needs. Send us your specifications. Better yet, visit our plant and see how and why Bridge reels are made so well at so low a cost.

WOOD REELS"

Get the EXTRA advantages of IMPROVED MORGAN-CONNOR WIRE MACHINES



EXTRA—You get the benefit of valuable years of unfailing production-line performance—plus the latest improvements in every Morgan-Connor wire machine.

EXTRA—You get big, heavyweight bundles, with reduced down time and unloading time.

EXTRA—You get one motor—simplified drive and low power costs.

EXTRA—You get extra floor space because of compact design.

EXTRA—You get efficient, trouble-free performance from every machine. Write us for further information.

MORGAN CONSTRUCTION CO.

WM-118

WORCESTER, MASSACHUSETTS, U. S. A.

ROLLING MILLS | MORGOIL BEARINGS • WIRE DRAWING MACHINES • COMBUSTION CONTROLS

WIRE AND WIRE PRODUCTS*

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 34 September, 1959 No. 9

Designated as Official Publication By The Wire Association

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CONSISTENT QUALITY
is wanted by most people but we often settle for less.
There is no need to settle for less when buying wire cutting tools.

CAREW cutters have given constant quality unequaled in 89 years.

MADE IN 4 SIZES 8", 10", 12", 14"

Jaws are made of hardened tool steel and are replaceable.

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SHUSTER® 1AVS Automatic

Wire Straightening and Cutting Machine variable speed - electrically controlled

The Production Booster with infinite variable speed control and The New Electro Mechanical Positive Release Target

CAPACITIES 1AVS—5

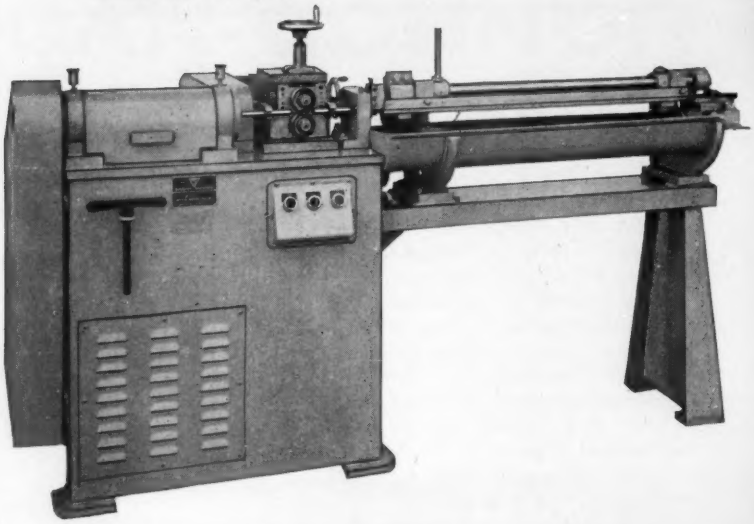
.062" to .250" basic wire
.062" to .148" spring wire
50 to 200 F.P.M.

CAPACITIES 1AVS—3

.062 to .187" basic wire
.062 to .125" spring wire
50 to 200 F.P.M.

Production:
Lengths up to 13"
144 pieces per minute

TIMKEN BEARING EQUIPPED



The BEST is *STANDARD* with SHUSTER!

Illustrated is the new 1AVS SHUSTER AUTOMATIC WIRE STRAIGHTENING and CUT-OFF MACHINE. Many new features are included as Standard Equipment on these High Speed 1/4" and 3/16" capacity machines.

Features include: High Speed Straightening Arbor with elongated split dies for proper bearing surface and optimum straightening speed, new Shuster Electro-mechanical positive release target, with electrically controlled tripping mechanism to instantaneously operate roll type clutch. Feed roll housing and fly wheel are Timken bearing equipped. All mechanisms are mounted on Shuster Welded Steel Base. Also included are new improved Guide Bar, Guide Bar Cover and a new Angled Control Panel together with properly engineered working height.

There are more SHUSTERS in use throughout the world than all other machines of its type.

SHUSTER

Wire Straightening and Cut-off Machines and Components are built in 49 models from .020" to 11/16" Mettler Machine Tool also manufactures the SHUSTER 5/16" capacity. Thread Rolling Machines

THESE MACHINES WILL BE EXHIBITED AT A.M.S. NATIONAL METAL EXPOSITION

Send us your wire straightening requirements from .020" to 11/16" for quotation.
Let us prove to you that a SHUSTER pays for itself faster than any other comparable machine.

METTLER MACHINE TOOL, INC.

155 West Adeline Street, New Haven, Conn.

VYGEN® special PVC compounds and resin

FOR WIRE AND CABLE COATING

In addition to Vygen 120 PVC resin, there are *three* specially-formulated Vygen compounds completely tested and UL-approved for specific wire and cable applications. Available in quantities to fit your needs, each Vygen compound and resin is composed of the very finest raw materials, processed in the most modern facilities. Each is designed to do its job better, *and* to save you money. Send for generous samples, literature and technical assistance.

VYGEN 6812 COMPOUND

UL-approved for UF-NMC cable, Type T, TW, 60°C, Oil, and 80°C appliance wire applications. May also be used as primary insulation for other cable constructions and jacketing.

VYGEN 6035 COMPOUND

UL-approved for Type T, TW, and exposure to oil use at 60°C. This compound combines excellent physical and electrical properties with very good weather and flame resistance.

VYGEN 9221 COMPOUND

Meets UL requirements for 90 and 105°C applications. Recommended for appliance, radio hook-up, machinery wire etc. where heat resistance and good physical properties are required.

VYGEN 120 RESIN

UL-approved as interchangeable with other PVC resins used as wire insulating material. For fast dry-blend extruding with monomeric or polymeric plasticizers—assures lack of gelled particles, excellent heat and light stability and long life.

TYPICAL ANALYSIS

Form	White Powder
Intrinsic Viscosity	1.18
Specific Gravity	1.40
Bulk Density, gm/cc	0.52
lbs/ft³	32.5
Volatiles	0.2

Creating Progress Through Chemistry

PHYSICAL PROPERTIES OF MOLDED SPECIMENS

	6812	6035	9221
Specific Gravity at 25°C/4°C	1.32	1.33	1.38
Tensile, psi at 25°C	2550	2950	3100
Modulus at 100% Elongation, psi	1450	1780	2150
Elongation, % at 25°C	320	315	340
Hardness, Shore A, inst at 25°C 10 sec at 25°C	90 82	94 86	97 92
Brittle Point, at – 15°C	Passes	Passes	Passes
Volume Resistivity, ohm-cm at 25°C and 50% R. H.	3.1×10^{14}	2.8×10^{14}	3.5×10^{13}

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO.

VYGEN

Forming no-sag springs. Pittsburgh Steel's 8 gage no-sag wire is bent into a regular no-sag spring for theater seat. Speed of operation and severe bending call for just the right combination of tensile strength and ductility.

No-Sag Spring Pioneer Uses Pittsburgh Steel Co. Wire Because Of 'Good Quality, Service, Delivery'

The company which introduced the no-sag spring in the United States 25 years ago today uses Pittsburgh Steel Co.'s No-Sag Wire because of "good quality, service and delivery."

Since 1934, No-Sag Spring Co. of Detroit has grown to a 22-plant operation, spreading from New Jersey to California and extending to a dozen foreign countries.

No-sag springs and the special no-sag wire from which they are formed were unheard of when the late Henry Hopkes Sr., founder of the firm, obtained patent rights from the German inventor and went into business in Detroit.

Now widely used in the furniture and automobile industries, no-sag springs made necessary the development of a special hard drawn, lead patented, high tensile wire made from selected steel heats. These specifications are met handily by the skilled steelmakers and wire drawers at Pittsburgh Steel Co.

No-sag wire has to be tailor-made because of the high-speed operation it undergoes on forming machines, many of which were designed by No-Sag Spring Co. engineers. Extra toughness is required to allow twisting short lengths to make ribbon lengths. Special restriction of cast is necessary for proper control in forming the springs.

Pittsburgh Steel consistently fur-

nishes coils of no-sag wire with ensile strengths up to 240,000 psi for wire .192 in diameter. At the ame time, the wire is ductile enough o be wrapped on its own diameter as a mandrel without cracking or breaking.

G. L. Stine, who heads up research nd development for No-Sag Spring Co., said:

"We have found Pittsburgh Steel wire to be of excellent quality and their service and delivery have been equally good. Pittsburgh Steel has certainly helped maintain and improve our reputation for quality springs in the industry."

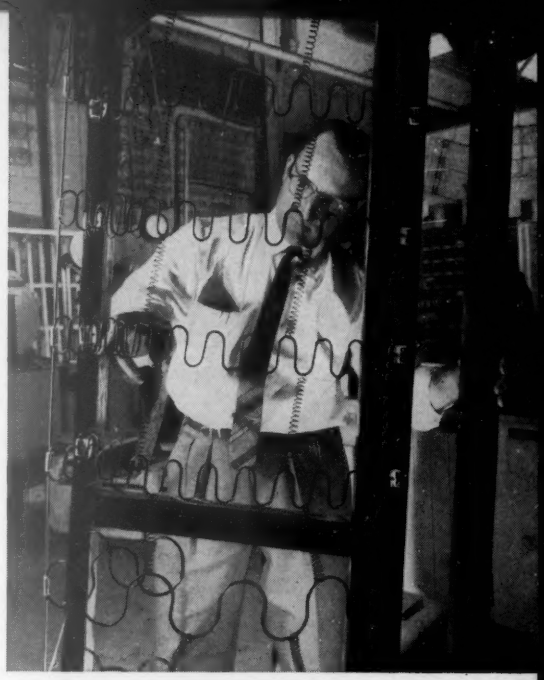
Close Tolerances—No-Sag Spring Co. also insists that the diameter be uniform and that the wire be free of surface defects, pipe or kinks.

The company forms wire into three general types of no-sag springs. Precise engineering at No-Sag Spring determines the best type of spring for any application.

Regular no-sag springs have the original size and shape loop that was first developed with a loop approximately 1⅞ inches wide and a ⅞-inch space between the parallel wires. XL-No-Sag springs have an extended loop with a loop size of 1⅞ inches and 1⅛-inch space between parallel wires. Supr-Loop strands have a loop size of three inches wide and 1¾ inches between parallel wires.

Whether you're making no-sag springs or using one of the other grades of wire—from rope wire to cold heading wire, you'll benefit from the steelmaking and wire-drawing skill which has gone into the development of such special wires as no-sag spring wire.

You'll like the same kind of service and deliveries which Pittsburgh Steel Co. gives the No-Sag Spring Co. Bring your wire needs or coiling problems to the trained people at Pittsburgh Steel Co. today. Help is as close as your telephone. Just call the sales office nearest you. See list below.



Experimental Department constantly seeks new applications. This new type of day bed shows two types of no-sag springs—regular loops in top half and Supr-Loops in bottom.

"Soft End" for easy chair seat is made so that end of spring remains free. Installed in chair, ends will be connected along edge of seat. Resiliency of wire can be depended upon to retain shape of spring. Freedom from defects in the surface of the wire provides uninterrupted production on No-Sag Spring's machines . . . cuts down rejects and losses from scrap.

Back springs for sofa have ends turned back on themselves to form V-Arcs.

Pittsburgh Steel Company

Grant Building • Pittsburgh 30, Pa.

DISTRICT SALES OFFICES

Atlanta	Cleveland	Detroit	Los Angeles	Pittsburgh
Chicago	Dayton	Houston	New York	Tulsa
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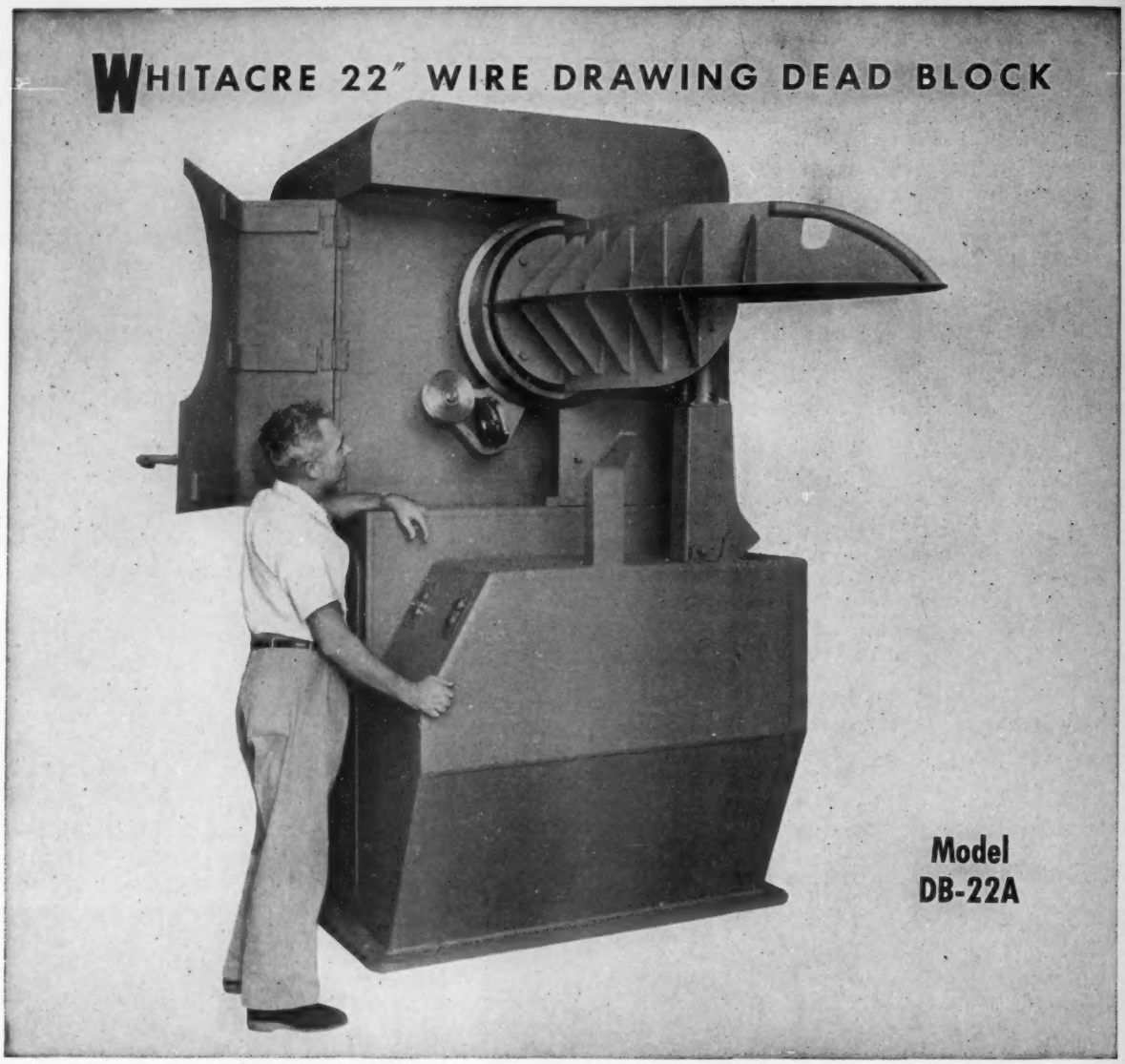
WHITACRE 22" WIRE DRAWING DEAD BLOCK



Continuous Production—Efficiency Approaching 100%

Gives you these advantages

Continuous increased production achieved by: • No down time for stripping • Permits packaging into stationary container or uninterrupted palletizing on stems • No tangling nor snarling from handling • Design simplicity. No back-gearing nor similar mechanisms • Greatly reduced floor space requirements • Dies in supplying drawing machine can be changed without stopping dead block • Accumulation type machines can be "run down" without stopping dead block • Continuous inspection and sampling • Breaks welded in production — low scrap loss • Increased production with lessened operator fatigue • Maintenance eliminated except for occasional lubrication of four main bearings and two motor bearings • Dead block can be located anywhere with wire literally piped from wire drawing machine • Extra large packages for in-process wire • Greatly reduced handling and in-plant transportation costs • Low capital investment.

OTHER MODELS AVAILABLE

16" Wire Drawing Dead Block, Model DB-16A • 26" Wire Drawing Dead Block, Model DB-26A • Combination 16" and 22" Galvanizing or Tinning Dead Block Take-ups, Model GB-2216A • 26" Heavy Wire Galvanizing or Tinning Dead Block Take-up, Model GB-26B.

Write Today For Specifications And Name Of Nearest Distributor

WHITACRE ENGINEERING & MANUFACTURING COMPANY

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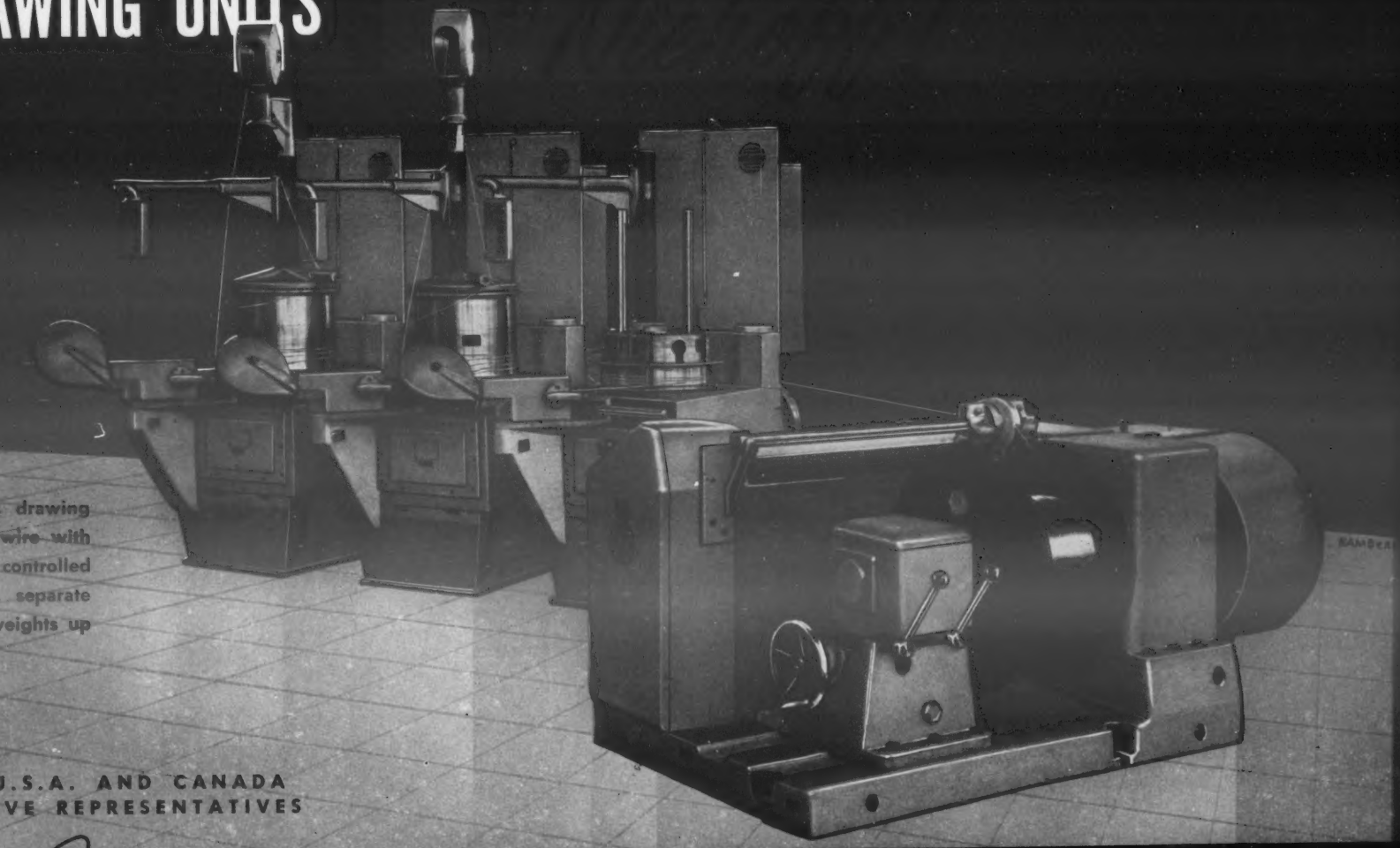
WHITACRE

WIRE DRAWING UNITS



Latest type slipless drawing machines for steel wire with fully electrically - controlled and synchronized separate spooler for spool weights up to 3,300 lbs.

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EXCLUSIVE REPRESENTATIVES

AMERICAN LAUBSCHER
Corporation

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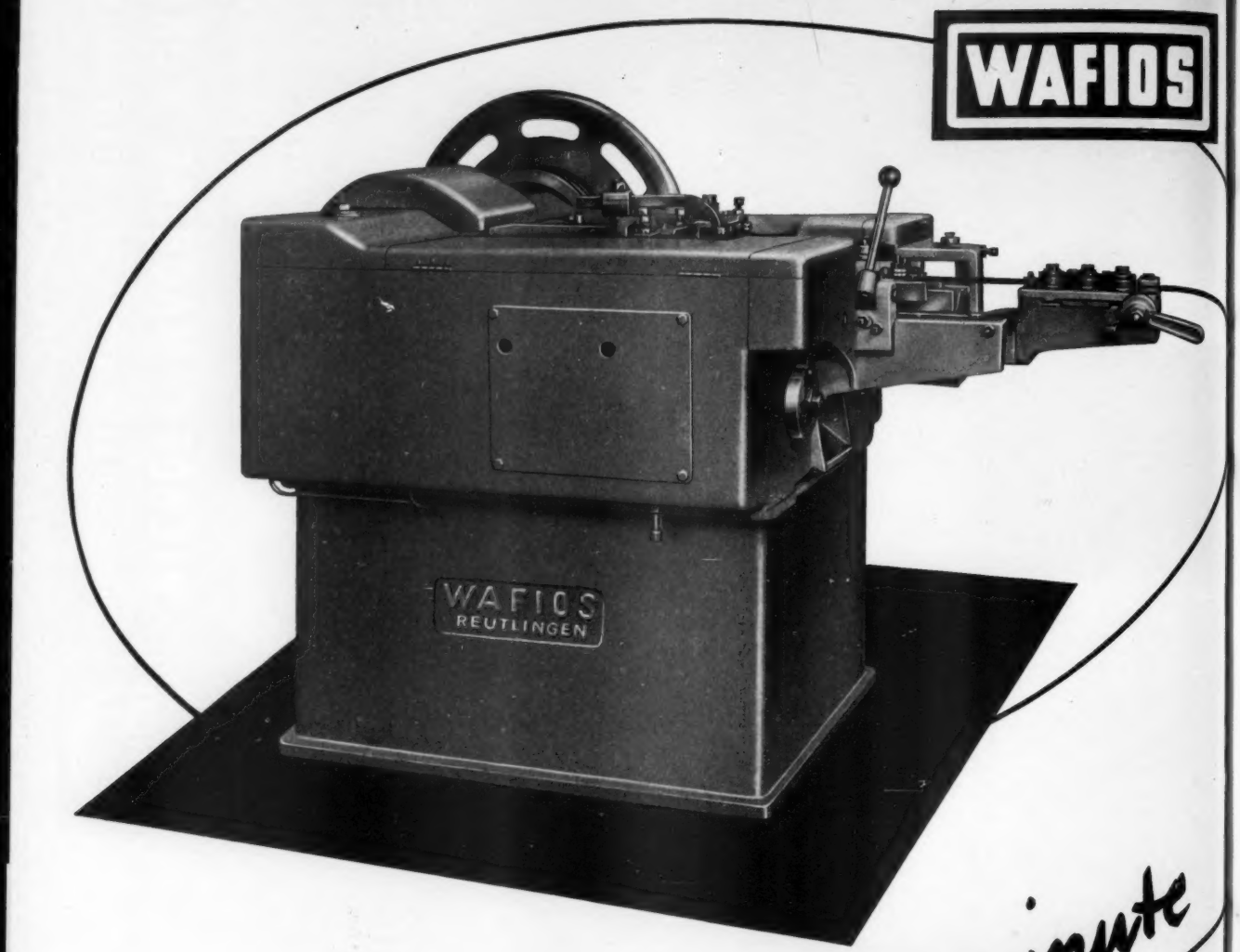
NEW YORK 19, N.Y.

NIEHOFF

NIEHOFF MACHINE WORKS

SCHWABACH NEAR NURNBERG WESTERN GERMANY



. . . up to 900 nails per minute

on WAFIOS High Speed Nail Presses Types „N"
a new development of

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Wagner, Ficker & Schmid
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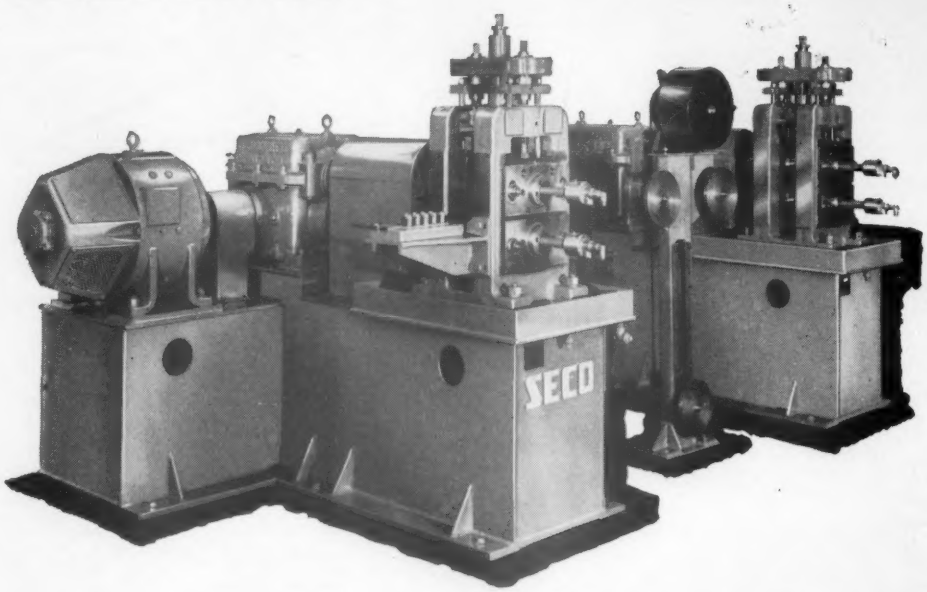
Predictable Performance

is yours when you change to

SECO WIRE FLATTENING MILLS



• Acceptable and predictable performance "on both sides of the fence" when Seco Wire Flattening Mills are used in your operation.

Seco's staff of trained engineers . . . specialists in solving production problems . . . are available for personal assistance to you. Call us today.

SECO

SECO STEEL MILL EQUIPMENT

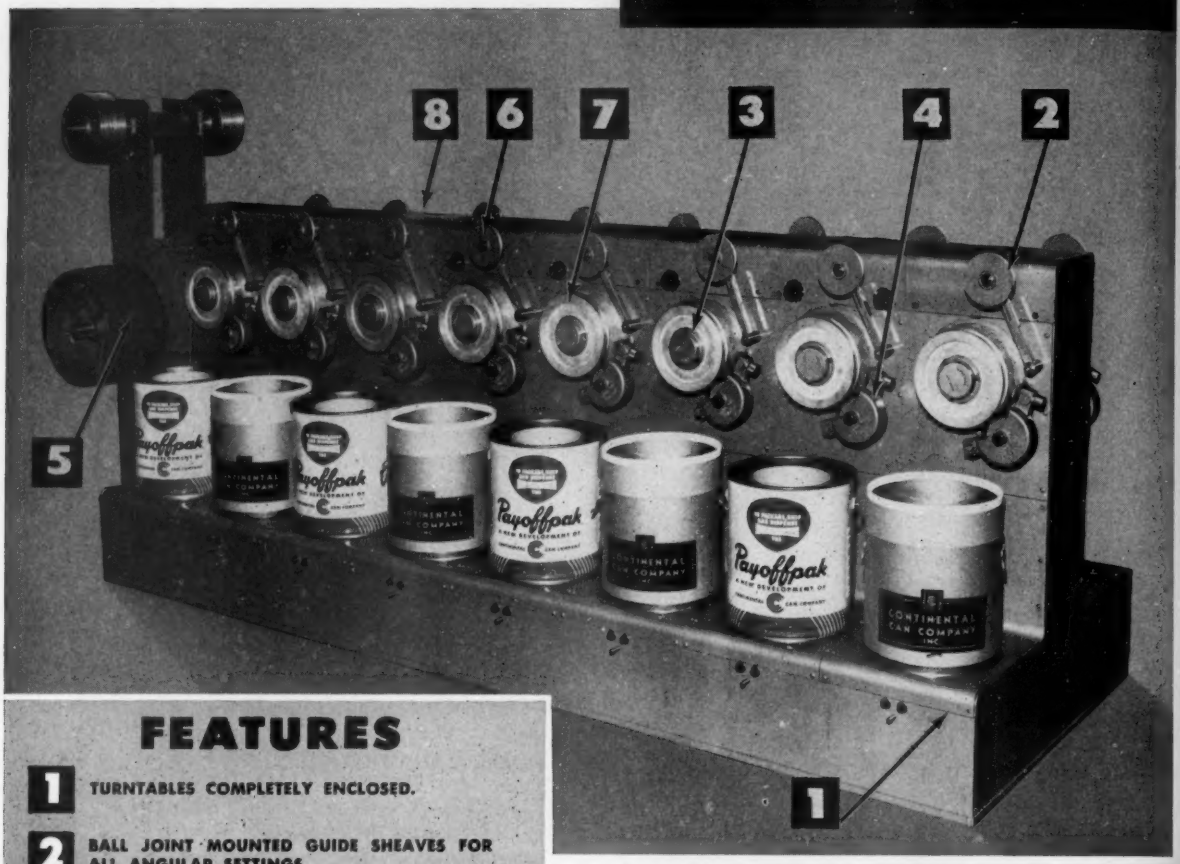
- Leveling and Shearing Lines
- Combination Edging and Flattening Lines
- Tension Reels for Strip Polishers
- Narrow Strip Grinding Machines
- Multiple Strand Pull-out Rolls and Take-up Frames
- Strip Coilers (Up and Down Type)
- Traverse Reels for Narrow Strip
- Steel Coil Up-enders
- Scrap Ballers

STEEL EQUIPMENT COMPANY

P. O. BOX 737, WARRENSVILLE STATION • CLEVELAND 22, OHIO

AFFILIATED WITH *Lee Wilson* ENGINEERING CO., INC.

ANNOUNCING the WYREPAK



FEATURES

1. TURNTABLES COMPLETELY ENCLOSED.
2. BALL JOINT MOUNTED GUIDE SHEAVES FOR ALL ANGULAR SETTINGS.
3. ELECTRO-MECHANICAL TENSION CONTROL FOR EACH HEAD.
4. PRECISION GROUND PRESSURE ROLLS.
5. PRIME RUBBER LAGGED CAPSTAN.
6. ASSEMBLED AND ALL ADJUSTMENTS MADE WITH ALLEN SCREWS.
7. ALUMINUM CAPSTANS, WITH HARD-ANODIZED, POLISHED RUNNING SURFACES.
8. INDIVIDUAL MAINTENANCE ON EACH SECTION.

The drum packaging Take-Up System illustrated, Model S5-TC-S, was designed especially for Magnet Wire.

Other models are made for all types of ferrous and non-ferrous wires.

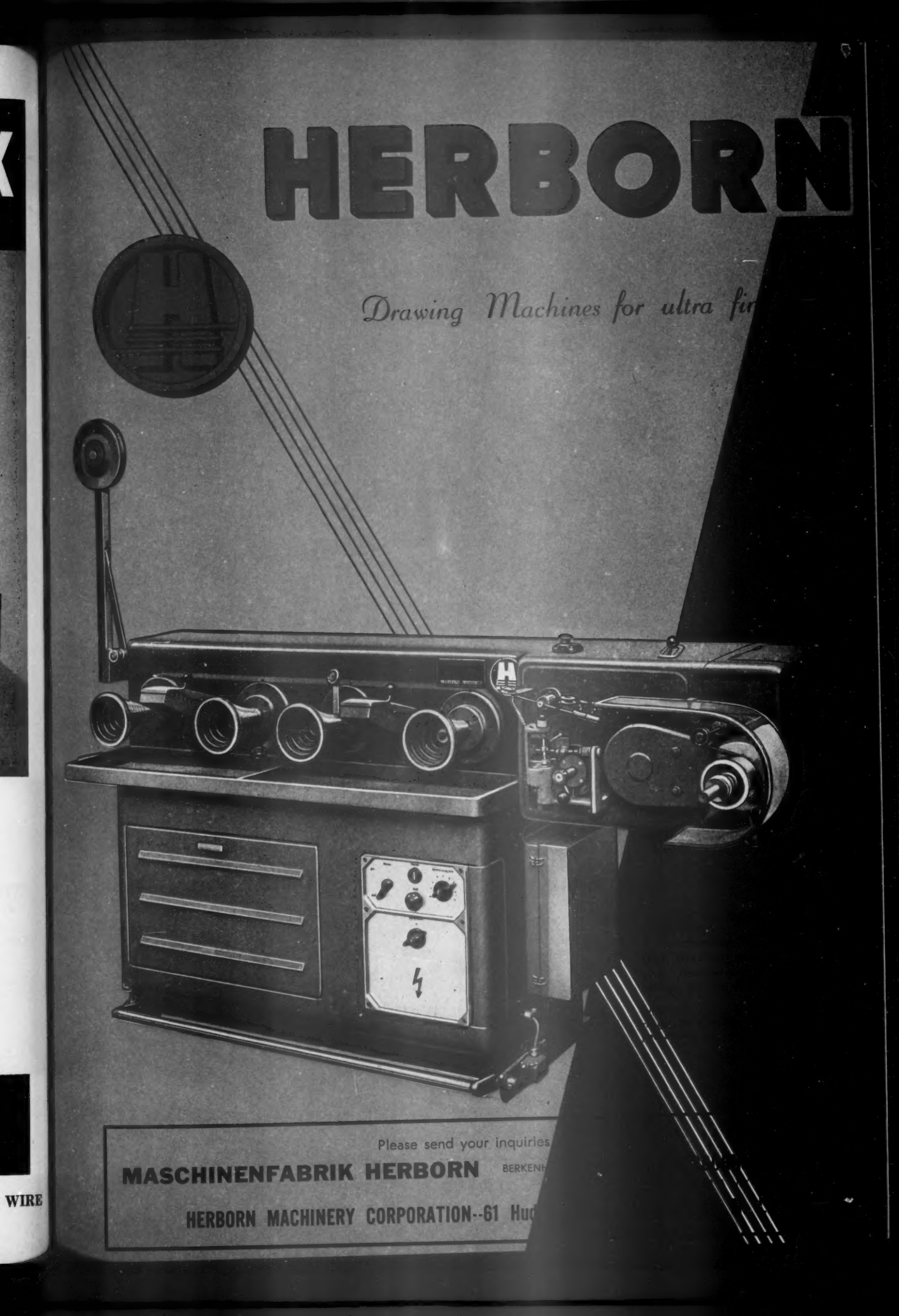
Advanced engineering and precision construction have evolved in this machine new concepts of speed and efficiency in the packaging of wire. Capacity: Min. size — #32 ga.; max. size — #20 ga. wire.

YOU ARE INVITED TO SECURE COMPLETE DETAILS REGARDING THIS ADVANCED PROCESS FROM —

Advanced Wyrepak Co., Inc.

11 HARRISON COURT PHONE: EDison 4-4274 BRIDGEPORT, CONN.

OR The Vaughn Machinery Co., CUYAHOGA FALLS, OHIO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Drawing Machines for ultra fi
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Copper & Copper Alloy Conductors
Aluminum Conductors
Neoprene Type
Polyethylene Type
Neoprene Type
Polyethylene Type
This table shows
POLYETHYLENE covere
I HAD THE BOSS UP A POLE...
DON'T GET ME WRONG...I STILL DON'T LIKE STORMS
"But they don't seem to hit us so hard any more.
Not since polyethylene coated wire came along."

TELLING THE POLYETHYLENE WIRE STORY CAN BUILD FUTURE PROFITS FOR YOU

Polyethylene-covered line wire has many advantages for users: Exceptional weather and stress-crack resistance. Easy handling and installation. Long life in service. Fewer outages and minimum maintenance.

We've been telling your customers the polyethylene story in utility magazines through advertisements like those above. And more and more users are specifying polyethylene covering for line wire and many other applications. Why not join us in this effort?

Polyethylene can make your operations simpler, with a more profitable future too.

- The resin comes ready-to-use — nothing to add, no blending, no milling, no post-extrusion vulcanizing. With production based completely on polyethylene, one line replaces several, providing savings in equipment, floor space, maintenance and labor. And there's only one material to purchase and inventory.
- Unlike costs of other insulating materials, which are trending upward, polyethylene price history promises long-term stability. This means polyethylene can be expected to be your most profitable line wire coating in the years ahead.

You can build a solid base for future sales and increased profits by promoting polyethylene line wire now among your customers and prospects.

As you make recommendations, you will find our new data sheet, "PETROTHENE® Resins for Wire and Cable Industry", helpful in selecting resins with the proper balance of properties for different applications. Also available is U.S.I.'s comprehensive 100-page "PETROTHENE Polyethylene . . . A Processing Guide." Write for your copies.

U.S. Industrial Chemicals Co.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.

Please send me:

☐ "PETROTHENE Resins for the Wire and Cable Industry"
☐ "PETROTHENE Polyethylene . . . A Processing Guide"

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U.S.I. INDUSTRIAL CHEMICALS CO.
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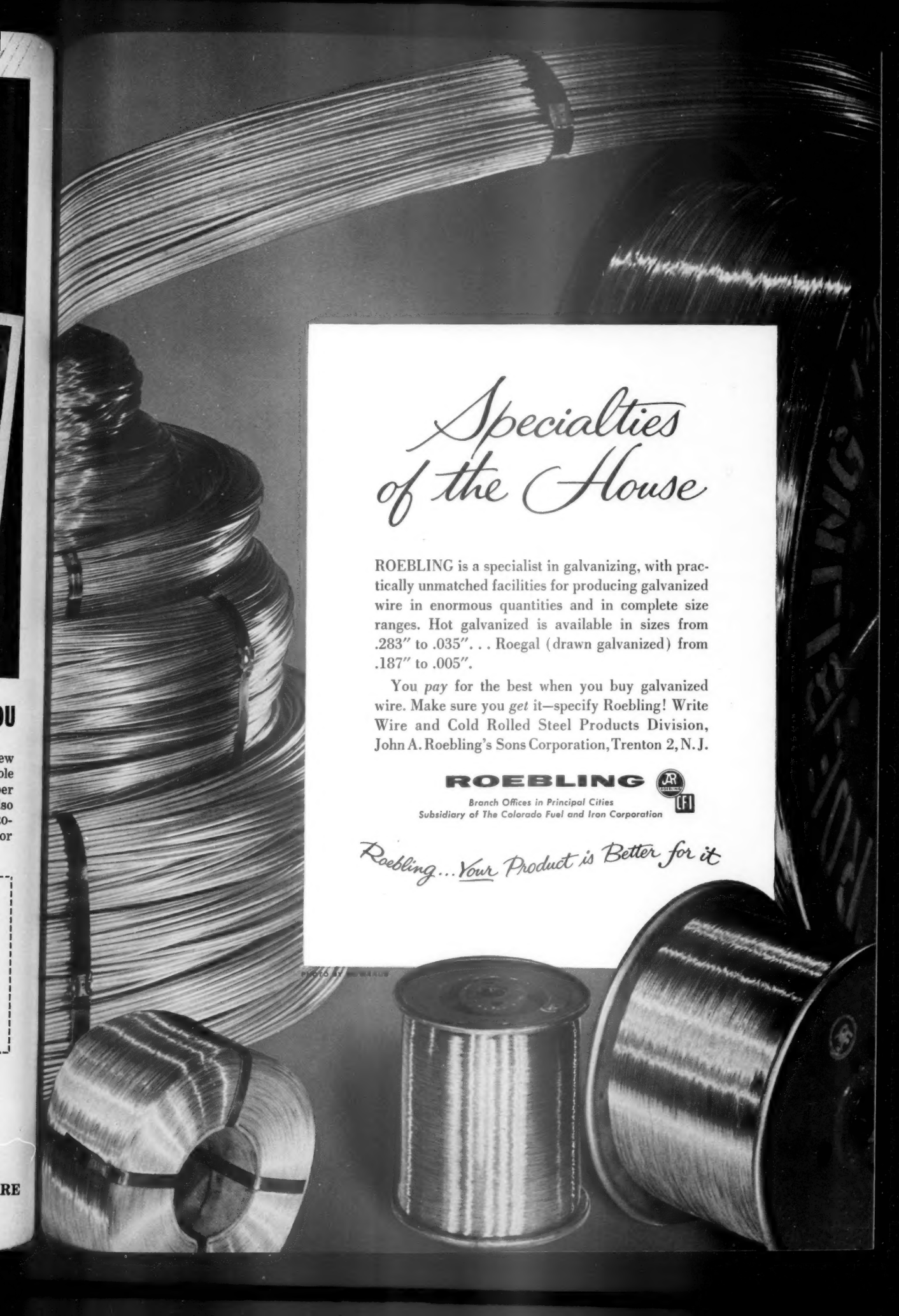

Specialties
of the House
ROEBLING is a specialist in galvanizing, with practically unmatched facilities for producing galvanized wire in enormous quantities and in complete size ranges. Hot galvanized is available in sizes from .283" to .035"... Roegal (drawn galvanized) from .187" to .005".
You pay for the best when you buy galvanized wire. Make sure you get it—specify Roebling! Write Wire and Cold Rolled Steel Products Division, John A. Roebling's Sons Corporation, Trenton 2, N. J.
ROEBLING
Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation
Roebling... Your Product is Better for it

DESIGNED TO MEET NEW DEMANDS UPON THE WIRE INDUSTRY...

VERSATILE MODEL "AD" MICROWELDERS ... FOR HARD-TO-WELD ALLOYS

MODEL "AD"
MICRO-WELD
AIR OPERATED
RESISTANCE TYPE
BUTT WELDER

In this modern age of rockets and atomic projects new demands are being made daily upon the wire industry. Close and continuous contact with the wire industry has resulted in a steady flow of improvements in MICRO-WELDERS to meet specific welding requirements.

Equipped with foot operated air clamps, with adjustable air control, two stage air operated upset mechanism with high pressure finish for forge action, 12 step quick action heat tap switch, straight slide water-cooled headpieces.

AVAILABLE IN THREE MODELS

AD-3
¼" to ½" diam. alum. and alum. alloy
¼" to ⅜" diam. copper and copper alloy
¼" to ⅜" diam. steel and steel alloy

AD-4
⅜" to ¾" diam. alum. and alum. alloy
⅜" to ⅝" diam. copper and copper alloy
⅜" to ⅝" diam. steel and steel alloy

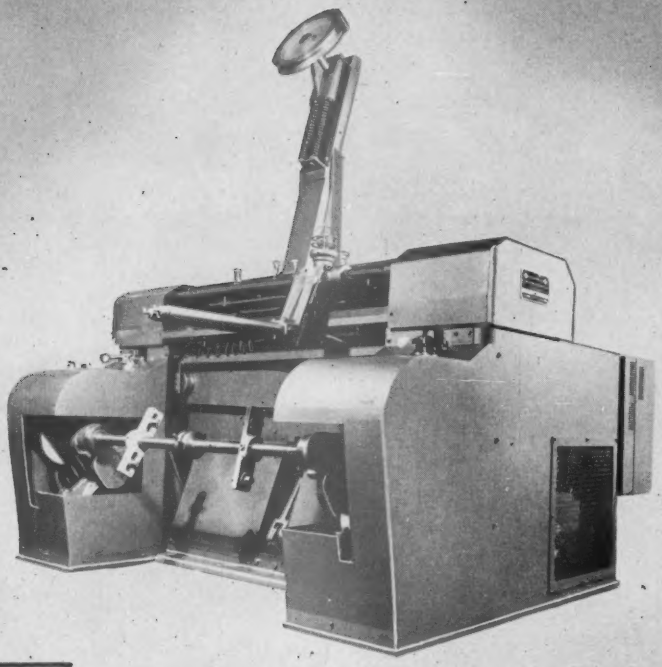
AD-5
½" to ¾" diam. alum. and alum. alloy
½" to ¾" diam. copper and copper alloy
½" to ¾" diam. steel and steel alloy

MICROMETER PRECISION MICRO-WELD ®

MICRO PRODUCTS CO.

20 NO. WACKER DRIVE • CHICAGO 6, ILLINOIS • TELEPHONE STate 2-7468

LOOK UP WITH



ENTWISTLE

THINGS DON'T HAVE TO LOOK DOWN BECAUSE OF A TIGHT BUDGET!

This "HOT" little number, of diamond quality, produces rocket performance at an attractive price.

YOU cannot buy any one-shaft-type machine elsewhere that approaches the "TE" and "THE" Entwistle Dual Continuous Take-ups either in performance, features, or, as complete at any price. As a matter of fact, non-automatic, "warmed-over" passe' designs, available elsewhere, are in the same price range.

YOU can't afford to miss knowing about our new "TE" and "THE" shaft-type continuous take-ups for reels up to 1400 Lbs. at speeds to 2000 F.P.M.

YOU handle 24" through 36" O.D. reels on one machine.

Obtain full details including firm quotation.

YOU get these built-in features:

- Eddy-current drive and controls.
- Adjustable, maintained speeds and tensions.
- Electric brakes and clutches.
- Pneumatic lift and cut-off.
- Infinitely adjustable traverse, pneumatically reversed.
- Predetermined, Motorized traverse crossover.
- Effortless, trouble free, silent service.
- Includes wire reservoir tower and measuring.

WRITE, CALL, OR FLY . . . BUT — DON'T WAIT.

Ask for Entwistle "3C" — *"The Deal of The Century"*

ENTWISTLE

Manufacturing Corporation

1475 ELMWOOD AVE., PROVIDENCE 7, RHODE ISLAND

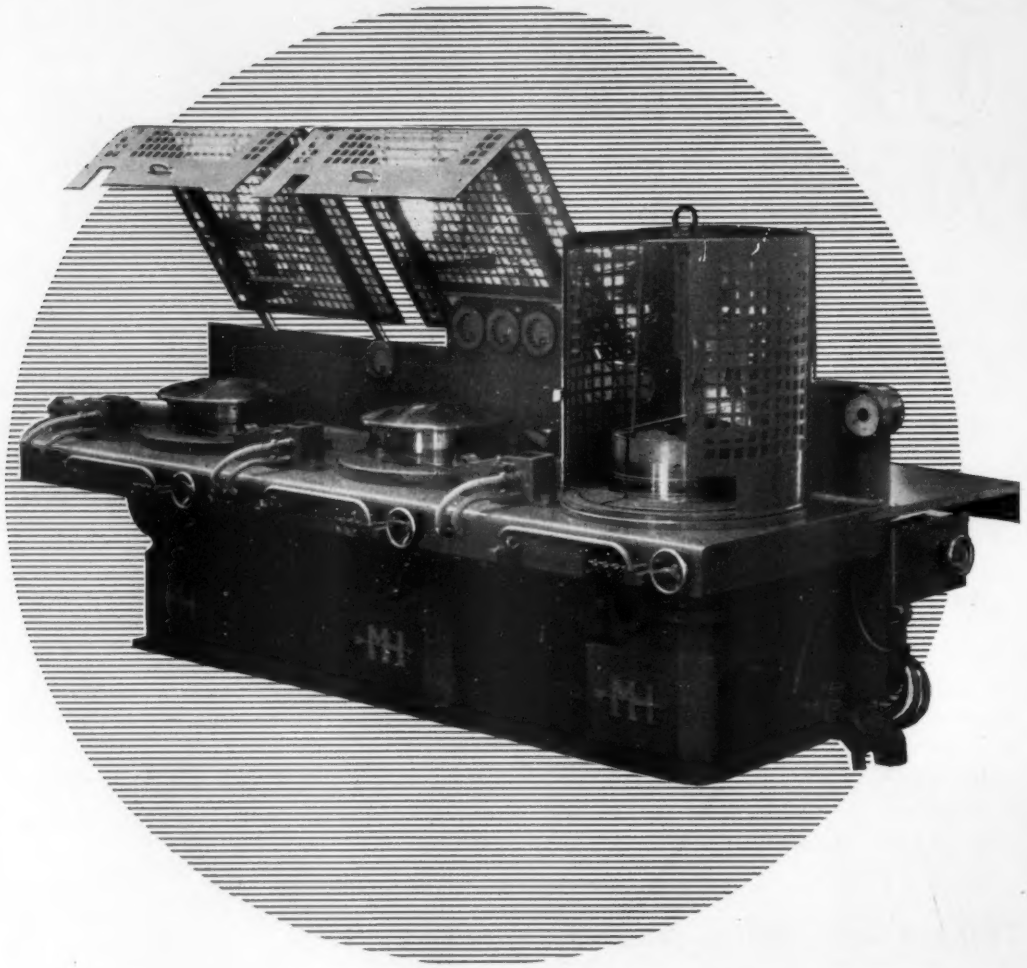
Over 40 years of dependable service to the Wire Industry

Europe, South America, Mexico
FOREL EQUIPMENT CORPORATION
30 Church Street, New York 7, New York

British Associates
THE KEMSON ENGINEERING CO., LTD.
Wellington Mill, Bolton Road
Blackburn, Lancs., England

THE BEELINE

WORLD WIDE
PRECISION WITH RUGGEDNESS



A BEELINE DG-4 similar to this, producing core wire for arc welding electrodes, will be shown in continuous operation together with a Straightening and Cutting machine, type M 700, from A B CURTO at the National Metal Exposition in Chicago November 2 thru 6. Booth #1542. . . . . .

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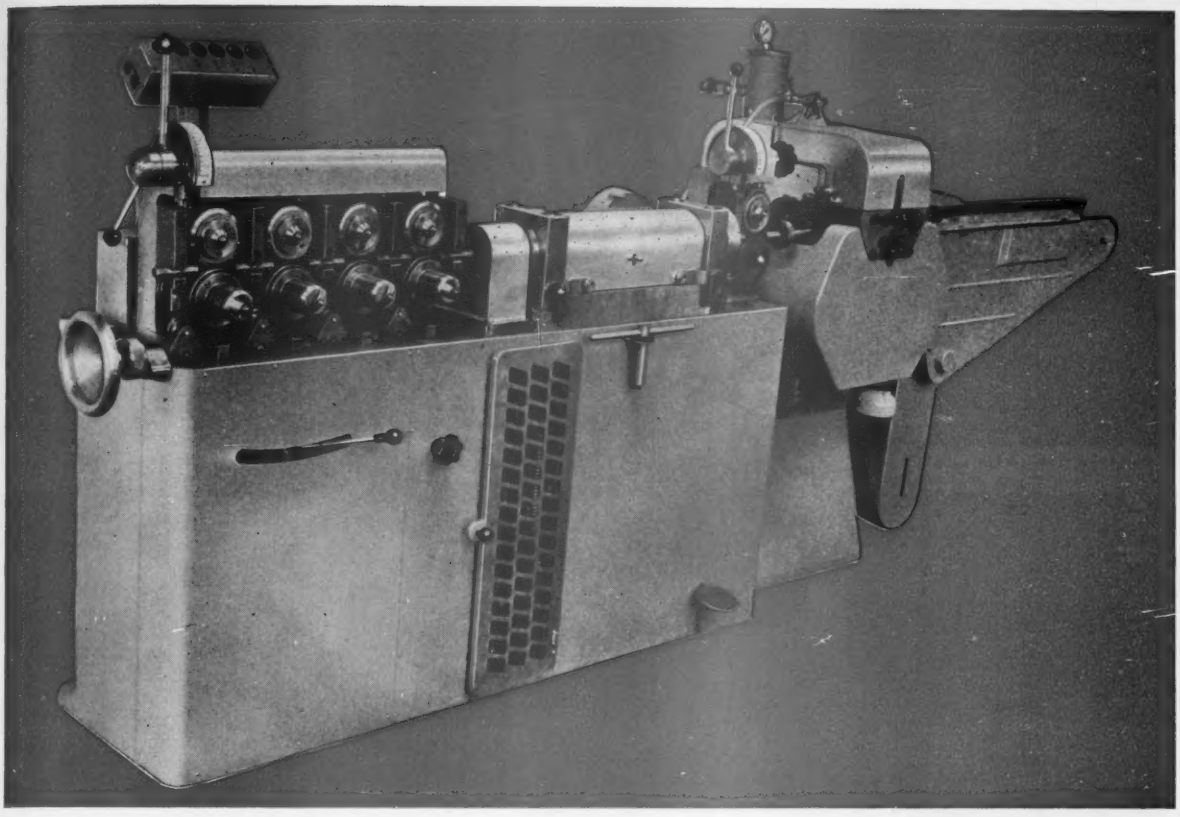
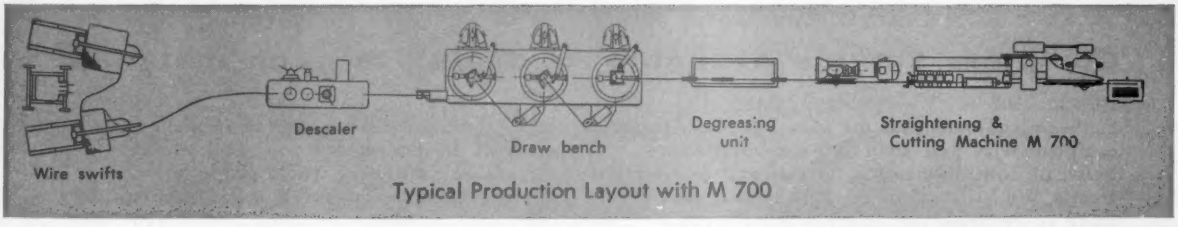


725 absolutely straight and burr-free rods

for example, 8 s.w.g. wire can be cut into 18" lengths at 725 cuts/min. with the M 700.

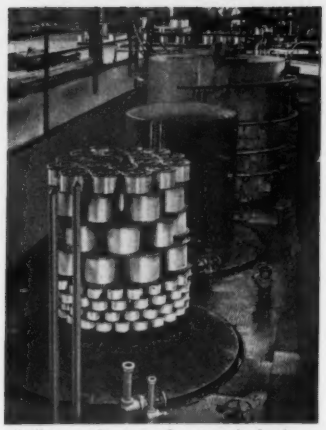


Typical Production Layout with M 700

Visit us at the Metal Show in Chicago, Nov. 2-5, and see the M 700 in action.

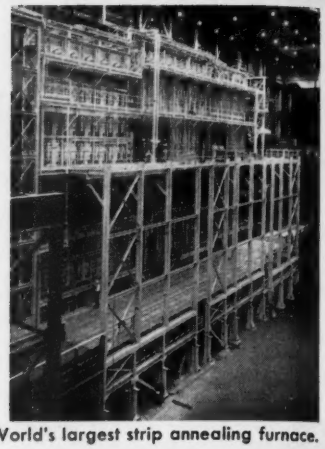
AB CURTO

P.O. Box 850
Gothenburg
Sweden

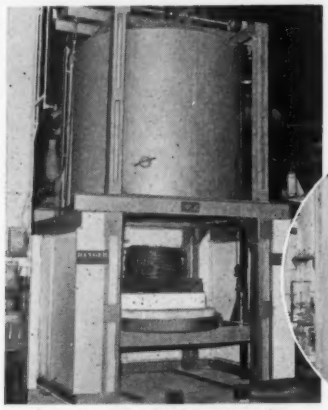


Bell type furnace for spooled wire.

Sunbeam WIRE and STRIP FURNACES

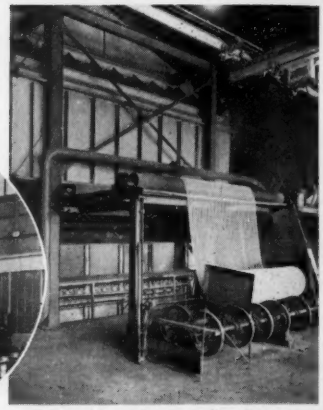


World's largest strip annealing furnace.

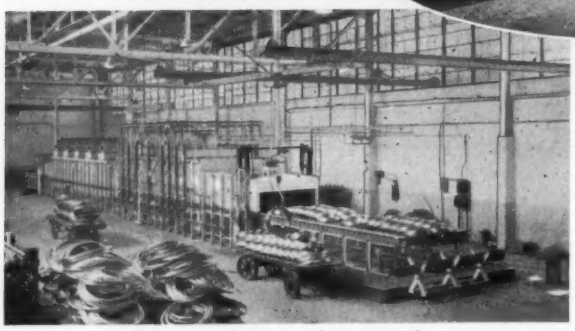


Elevator furnace for wire coils.

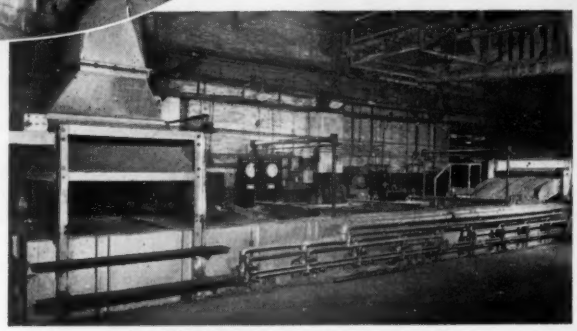
Bell type furnace for wire or strip.



Galvanizing furnace for fencing.



Roller hearth furnace for wire coils.



Lead bath furnace for wire in strands.

Complete service available . . . design through installation

Sunbeam equipment for the metals industry includes complete wire and strip furnace installations . . . batch or continuous—for ferrous and non-ferrous metals. We build the largest, the smallest and everything in between. All auxiliary equipment for heat treatment including cleaning, cooling, fluxing, coating, atmosphere generation, process and control panel, and handling equipment can be furnished as a single contract. In this manner you obtain the many added advantages of dealing with a single supplier—in purchasing, planning, delivery, installation and service. Whether planning an expansion, opening a new plant or replacing equipment, it will pay you to see Sunbeam first. Let us know your requirements.

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THE BEST INDUSTRIAL FURNACES MADE

Sunbeam EQUIPMENT CORPORATION

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7 reasons why you should SEE THE BLANE MAN for color concentrates

1. Uniform size pellet — for even color dispersion.
2. No color contamination in factory as pellets provide a dust free concentrate.
3. Blane color concentrates give rapid and full dispersion under heat.
4. Concentrations per pound yield maximum color power.
5. Blane concentrates have proven to be excellent for heat stability and light fastness.
6. Non migratory and acid alkali resistant.
7. Greater economy — personal service.

We have in inventory all NEMA colors; special color concentrates are available on custom basis. Our laboratory people will be pleased to assist you on any color problem. Write for information and samples.

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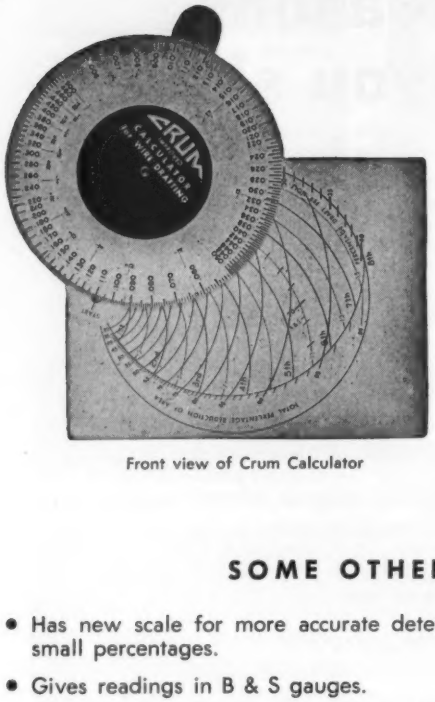
CANTON, MASSACHUSETTS

SAVE SET-UP TIME WITH THE...

CRUM CALCULATOR
FOR WIRE DRAFTING

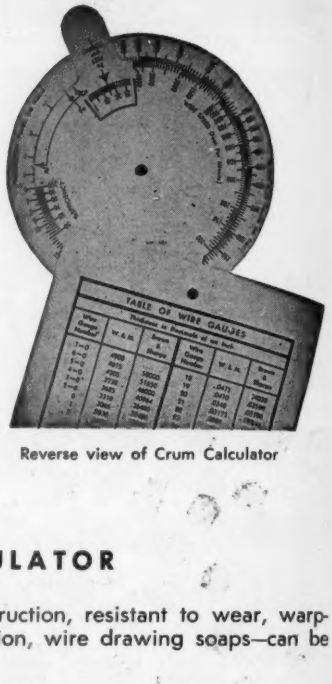
Useful and Accurate!



Front view of Crum Calculator

THIS NEW DOUBLE-PURPOSE CALCULATOR WILL:

1. **Provide quicker and more accurate information on die sizes and reduction areas;**
2. **Calculate wire production rates for various speeds and efficiencies.**



Reverse view of Crum Calculator

SOME OTHER FEATURES OF THE CALCULATOR

- Has new scale for more accurate determination of small percentages.
- Gives readings in B & S gauges.
- Intermediate lines provide reductions for 16 holes in one setting.
- New rectangular shaped back for better protection of calculator.
- More legible % draft-per-hole scale.
- Vinyl plastic construction, resistant to wear, warping, dirt, perspiration, wire drawing soaps—can be cleaned.
- Still fits your vest pocket.
- Handy tables of W & M and B & S gauges.
- Feet per pound calculating scale for steel, copper and aluminum wires.
- Durable, accurate, easy to use.

The improved Crum Calculator is worth its weight in gold in time saving—no laborious mathematical calculations necessary when you use it. Instruction sheet with examples accompany each Calculator. You should have one or more in your wire drawing department.

THE PRICE: $5.00 EACH

Send your orders to:

WIRE AND WIRE PRODUCTS

453 MAIN STREET **STAMFORD, CONN.**

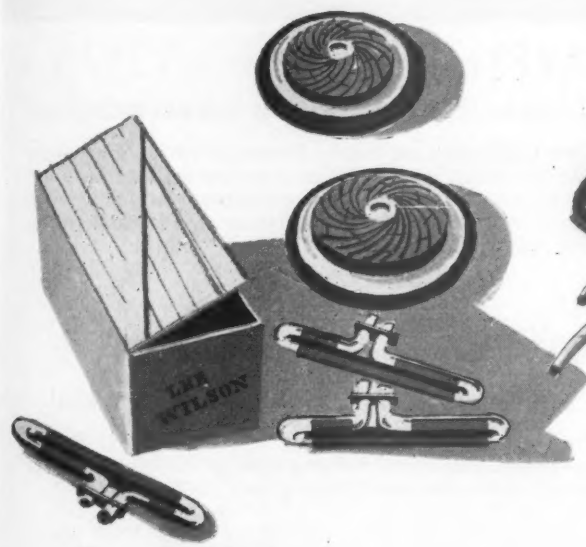
(Exclusive distributors)

New Life for old wire furnaces

Rebuilding outmoded furnaces—adding high input "O" tubes and high velocity circulation systems—increases the average wire annealing production by at least 40 percent, with no increase in floor space requirements.

Lee Wilson engineers have developed a wire furnace modernization program that will bring your old furnaces up to date quickly at a minimum of expense.

Why not look into the Lee Wilson plan. The details are available by contacting the Lee Wilson representative in your area or writing direct.



Lee Wilson* **ENGINEERING COMPANY, INC.**

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HIGH CONVECTION ANNEALING FURNACES

MAKE THE BEST METALS BETTER

*ORIGINATORS AND LEADING PRODUCERS OF HIGH CONVECTION ANNEALING FURNACES

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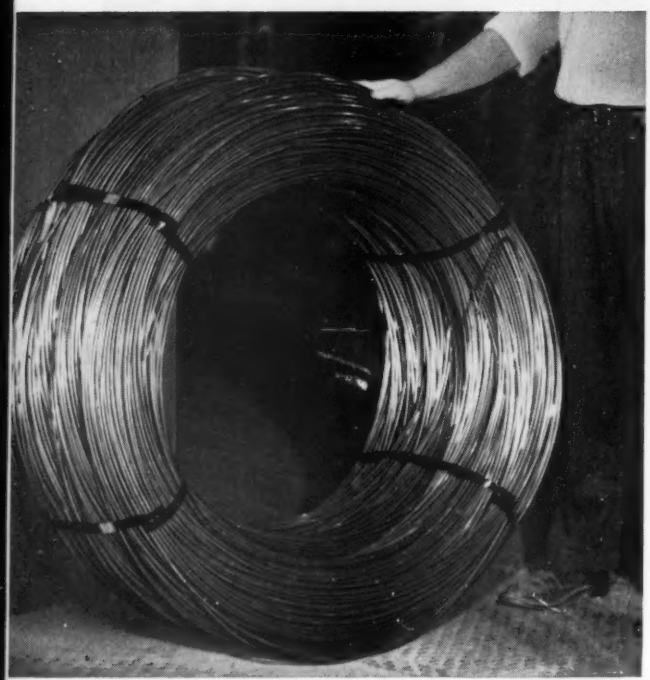
NOW-SAVE TIME with new AS&W



SAVE! HEAVYWEIGHT COILS

save down time, handling time and storage space!

These continuous wire coils, weighing up to 2,000 pounds, speed up mill production by reducing down time for reel changes; save on handling and storage since one large coil takes the place of several smaller ones of same total weight. Heavyweight coils carry no price extra!

SAVE! UNITIZED COILS

cut down handling operations, make more efficient storage!

Where your machines cannot accommodate extra long-run coils, these unit packs offer great saving in handling time and storage space. One unit, containing several smaller coils, is easily handled; takes up less storage space than the same coils stored separately.

SAVE! PLATFORM COIL CARRIER

—ideal for ordering, handling large quantities of wire!

The disposable platform coil carrier, made up of U-shaped wire fastened to a platform, can hold up to 3,000 pounds of special wires in one continuous length.

USS American

AND SPACE Wire Packages!

SAVE! PAY-OFF DRUMS

speed up handling, storage—protect wire finish!

Long-run continuous coils of wire are packed and delivered in heavy fibre containers. These Pay-Off Drums are easy to handle and stack for storage; ideal for use where wire finish requires special protection from dirt and mill atmospheres. Size of wire, length and weight of coil to your specifications. No return on containers.

SAVE! DISPOSABLE SPOOLS

are easy to handle and stack, take up little space!

These new non-returnable spools can be supplied with any amount of fine wire from 5 pounds to 65 pounds. They are easy to handle individually, and when shipped in quantity are delivered 36 to a pallet, ready to store as is.

Another American Steel & Wire "Customer Service" Feature

These new American Steel & Wire Packages are designed to help you save storage space, to reduce your handling time to a minimum and to speed up your production lines. For more information on these packages and the ways to use them to plan for better warehousing, get in touch with American Steel & Wire. General Offices: 614 Superior Avenue, N. W., Cleveland 13, Ohio.

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Manufacturers Wire

USS

American Steel & Wire Division of United States Steel

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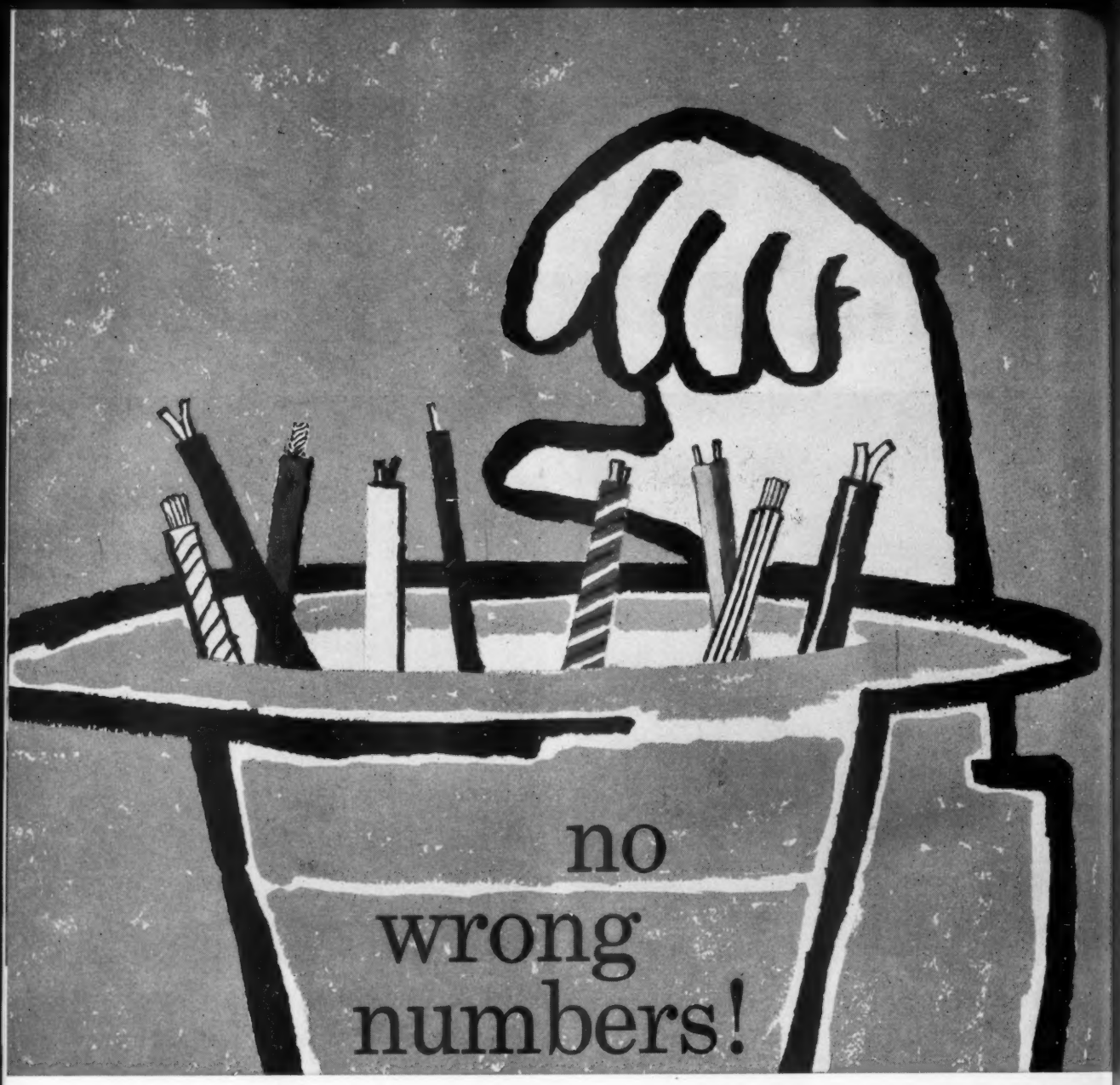

MONSANTO POLYETHYLENE formulations are based on long experience in supplying the specialized needs of the Wire and Cable Industry. That's why you can always count on a correct answer to your specific insulation problem, when you call Monsanto Chemical Company, Plastics Division, Springfield 2, Massachusetts.

*OPALON: REG. U.S. PAT. OFF.

Monsanto

MPE 10 medium molecular weight natural, with non-discoloring antioxidant; primary insulation for telephone cable, power cable, control cable, and general insulation use.

11302 medium molecular weight black, with non-discoloring antioxident; for line and drop wire insulation, weather-resistant primary and support wire insulation, general purpose jacketing.

12203 high molecular weight natural, with non-discoloring antioxidant; primary insulation for telephone, power, and control cable; insulation requiring superior toughness, maximum stress crack resistance.

12253 medium molecular weight natural, with non-discoloring antioxidant; for primary insulation for coaxial cable, power cable, telephone cable, and general insulation use.

14202 high molecular weight black, with non-discoloring antioxidant; telephone and power cable jacketing; all jacketing and insulating applications requiring maximum stress crack and weather resistance.

Monsanto has also developed a complete line of Opalon* Vinyl compounds for wire and cable insulation.

Are you receiving your monthly "WIRE RECORDER"? Use coupon to get this useful news bulletin published by Monsanto.

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Plastics Division,
Springfield 2, Mass.

Please place my name on your mailing list to receive free monthly copy of "WIRE RECORDER"

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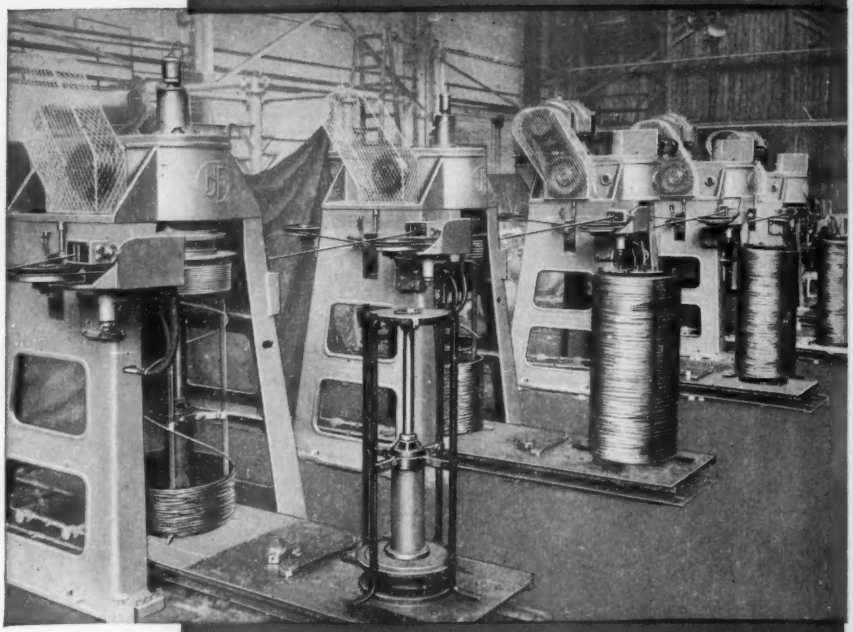
SIR JAMES FARMER NORTON & CO. LTD.

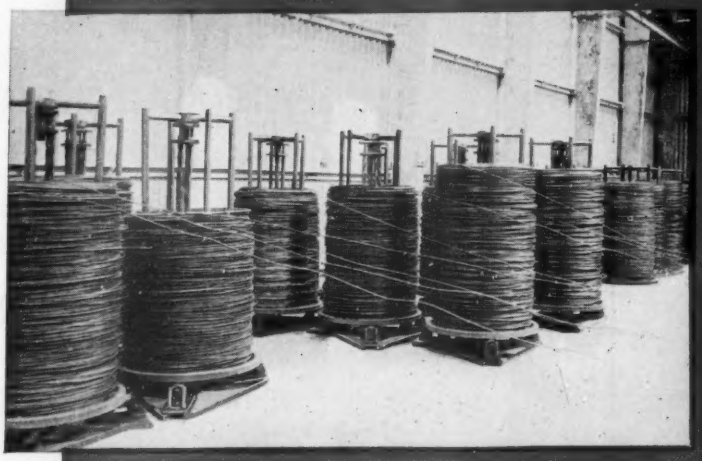
and their representatives

STEEL & WIRE MACHINERY CO.

Farmer Norton Gravity blocks for handling large coil weights. These can be built for coils up to 2,000 lb or larger. The units can either draw or wind as required. Can be fitted with constant or variable speed motors. DO NOT TWIST THE WIRE. This is essential for Carbon Steel wire. Are built in block sizes from 36" to 12" diameter.



Five Double Draft Gravity blocks drawing 15 cwt coils of mild steel wire 5.4 mm to 3.7 mm or Single Draft 5.4 mm to 4.4 mm. Drawing speeds 600 ft./min and 800 ft./min. All five of these blocks are operated by one man.

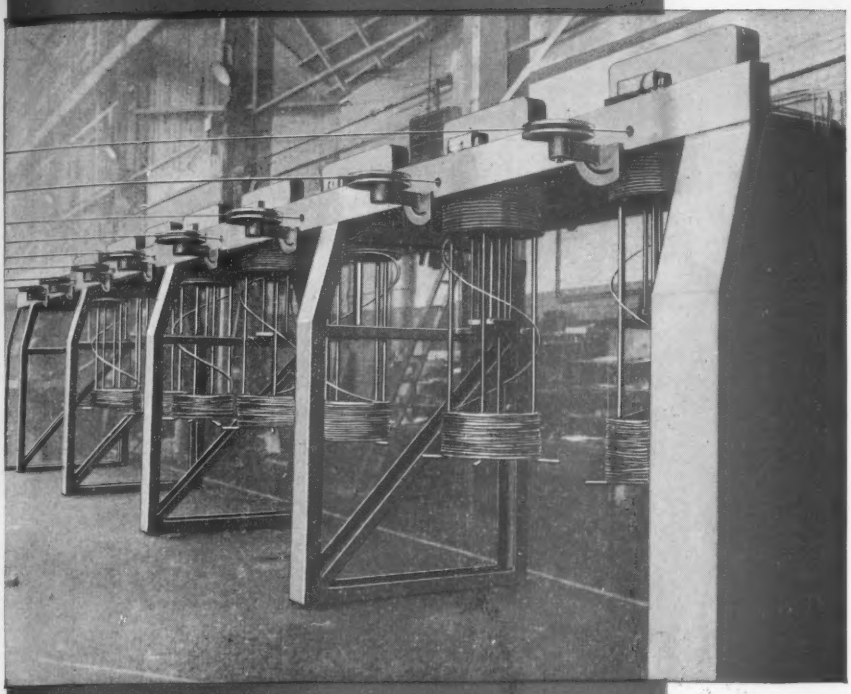


Large coils of this type drawn on Gravity blocks are ideal for feeding cutting machines, nail machines, patenting and galvanising furnaces etc.

SIR JAMES FARMER NORTON & CO. LTD.,

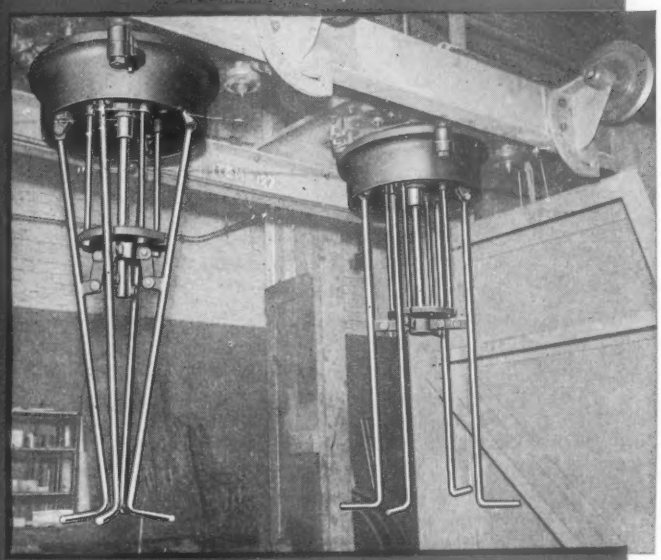
ADELPHI IRONWORKS, ADELPHI STREET, SALFORD, 3 ENGLAND. Telephone BLAckfriars 3613/4/5

Agent: Steel & Wire Machinery Inc., 15457 Euclid Avenue, Cleveland 12, Ohio, U.S.A.



Eight head machine for collecting Galvanised wire 5mm - 1.6 mm. in 1,000 lb coils. Drive through variable speed oil gear to give winding speeds of 0 - 150 ft/min. For larger coils up to 2,000 lb a different design of wire collectors is used.

OVER 100 GRAVITY BLOCKS SUPPLIED TO OUR CUSTOMERS THROUGHOUT THE WORLD



Take up frames for Galvanising, tinning and heat treatment.

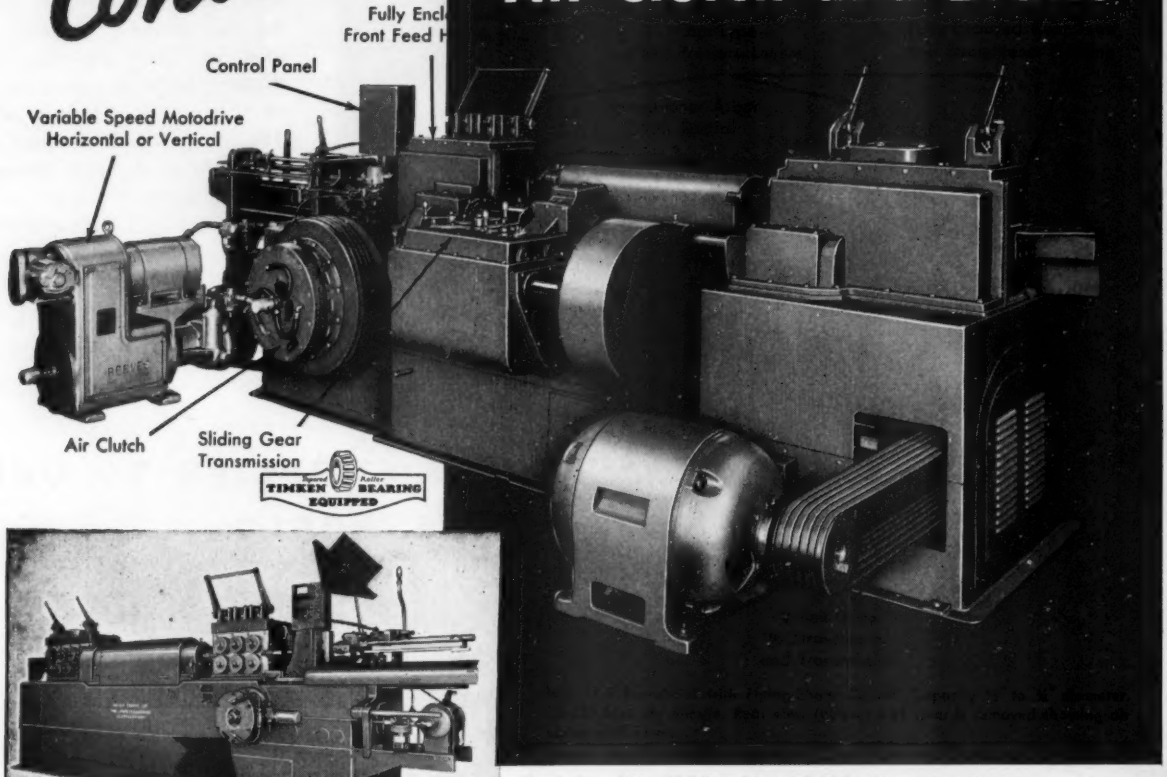
The strippers are collapsed pneumatically.

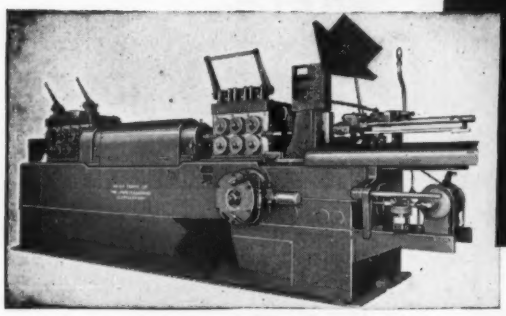
SIR JAMES FARMER NORTON & CO. LTD. are pioneers of the Inverted block system of drawing.

Better Quality Control *

LEWIS

Wire Straightening and Cutting Machines with Air Clutch and Brake





Front view of No. 11-F Travel-Cut with Flying Shear Cut-off showing Air Brake "A" (with guard removed) and operating panel "B" with push-button controls for Air Clutch, Reeves Motodrive and flywheel speed Indicator Tachometer.

● Lewis engineers have added three important improvements to their famous Travel-Cut Machines for BETTER QUALITY CONTROL . . . These machines are already in service in America's leading steel and wire mills.

✳ Wichita Air Clutch permits higher cut-off speeds, eliminates shock of conventional clutch. No adjustment necessary . . . automatically compensates for wear.

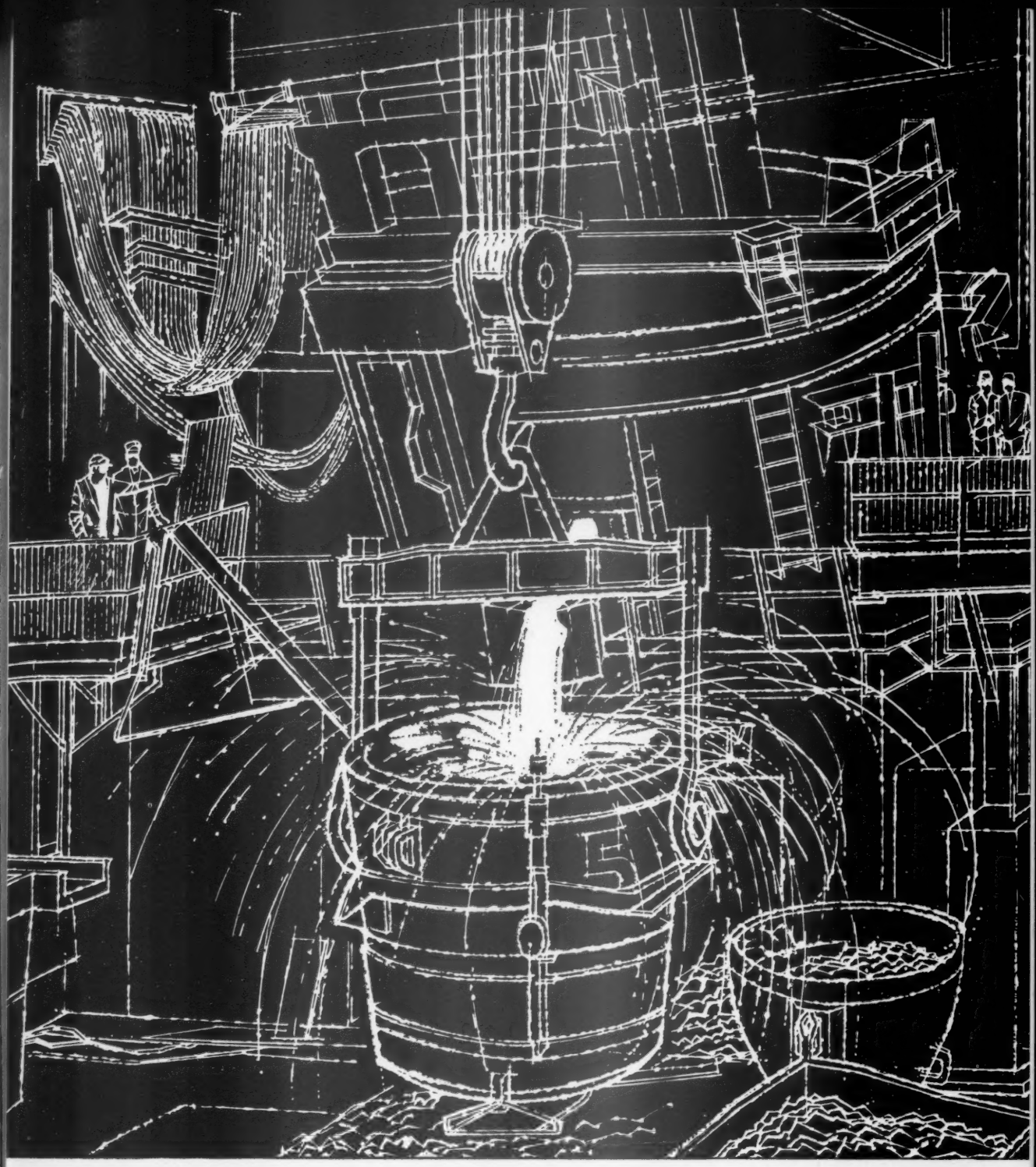
✳ Wichita Air Brake eliminates conventional mechanical drag brake and is only engaged for a short portion of the cut-off cycle.

✳ Reeves Variable Speed Motodrive permits infinite adjustment of flywheel speed for perfect synchronization of the cut-off and wire feed speeds. This unique arrangement makes possible the cutting of rod WITHOUT SPOT SWELL . . . allows finer adjustment for cutting short lengths. Dial tachometer registers flywheel speed.

There are Standard Lewis Travel-Cut or Stationary-Cut Machines designed to straighten and cut all materials and shapes in wire or rod from .012" to ¾" at a wide range of feed speeds.

Air Clutch available on all Travel-Cut Models. Send for new brochure showing complete line of Lewis Wire Straightening and Cutting Machines.

LEWIS MACHINE COMPANY 3440 East 76th Street Cleveland 27, Ohio



Wire Quality Starts Here

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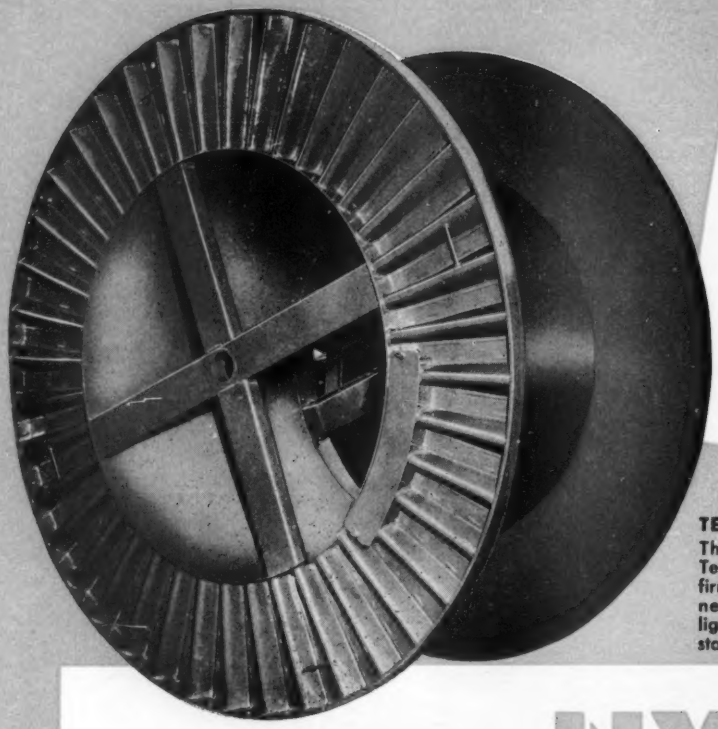

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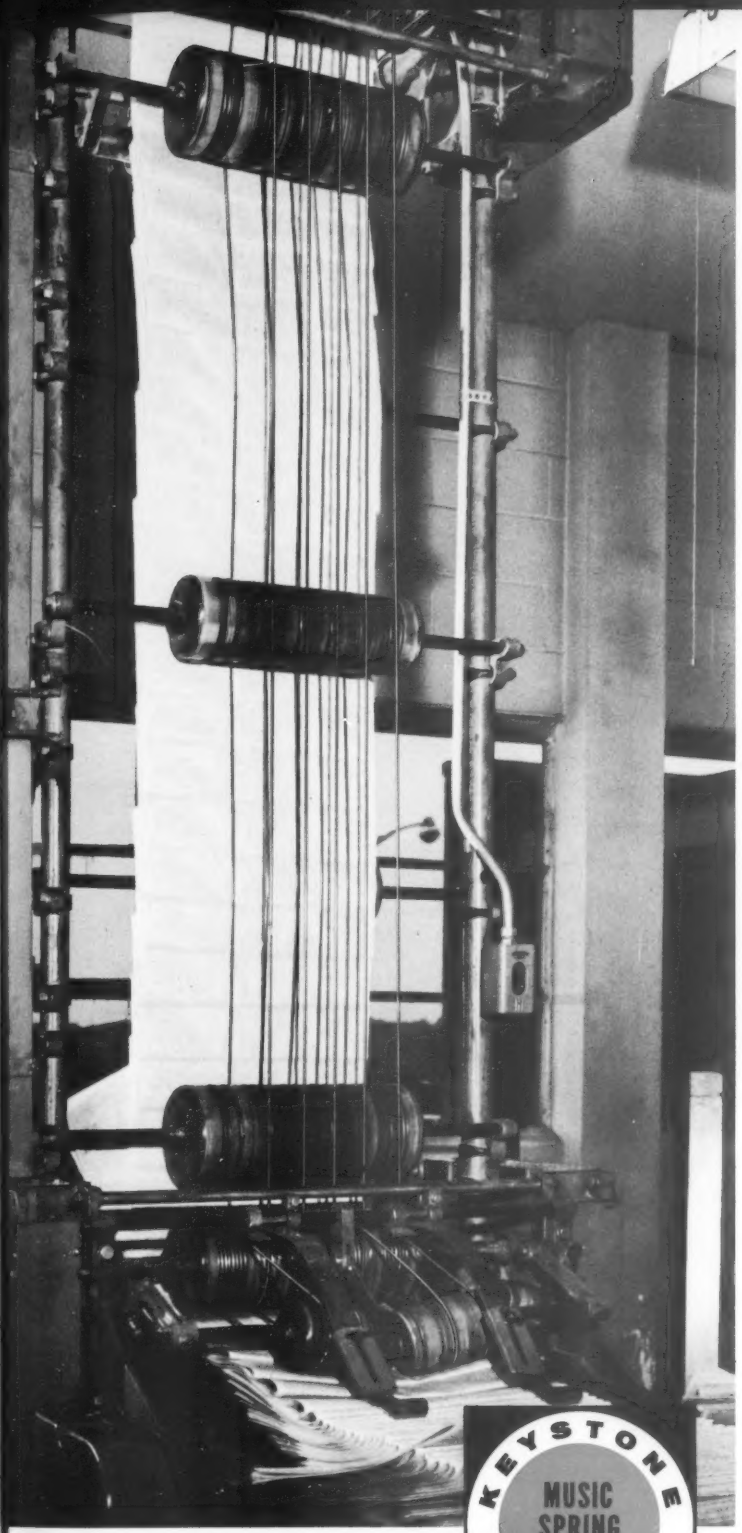

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KEYSTONE MUSIC SPRING WIRE STUDY

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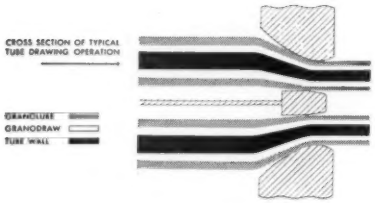
AMCHEM Information Bulletin

CHEMICAL CONVERSION COATINGS and their functions in facilitating the cold mechanical deformation of metals

By ARTHUR DAHL, Product Development Dept., AMCHEM PRODUCTS, INC.

When used to facilitate the cold mechanical deformation of metals (in drawing, extrusion, stamping, cold heading, necking, and upsetting operations) chemical conversion coatings in conjunction with suitable lubricants perform three important functions. One, they prevent metal-to-metal contact between work and tool. Two, they prevent galling and seizing. Three, they protect stock indefinitely, permitting the storage of in-process work at any stage of production, without danger of corrosion damage.



Characteristic of the tightly bound, highly absorptive, crystalline coating formed by the processes is the ability of the coating to retain lubricity throughout forming operations when treated with a suitable lubricant. This offers the following production advantages:

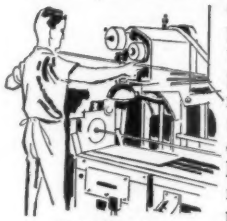
- **Higher degree of reduction**
- **Greater speed of draw**
- **Longer tool life**
- **Fewer process anneals and pickling**
- **Finer surface finish**
- **Cleaner mills**
- **Easier inspection of finished product**

Also of interest to production men is the exact duplication of coatings from batch to batch. And the processes are much simpler than other methods of coating metals—baths can be set up and running in less time than it takes to determine suitable coatings by other methods.

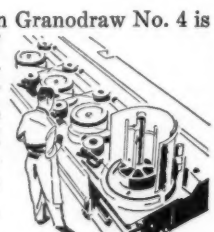
TYPES OF COATINGS AND THE METALS FOR WHICH THEY ARE DESIGNED

Zinc phosphate coatings for carbon steel. These coatings can be applied by either dip or spray systems.

Dip. Amchem Granodraw No. 1 is typical of the dip process. The sequence includes precleaning, water rinse, pickling, water rinse, water rinse, Granodraw No. 1 solution, water rinse, and a hot neutralizing rinse. Surfaces to be treated must be free of oil, grease, rust and scale. The above sequence insures that they will be. And when metal is free of rust and scale, the pickling bath and two succeeding water rinses can be omitted. In either case, a lubricant like Amchem Granolube or conventional lubricant must be applied prior to working the metal.

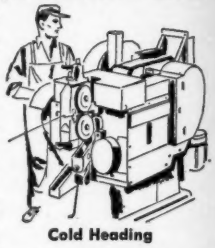

Tube Drawing

Spray. Amchem Granodraw No. 4 is an example of the spray process. It usually requires 5-stage equipment and includes the following steps: precleaning, water rinse, Granodraw No. 4 solution, water rinse, lubricant. After chemical treatment, the work must be dried before forming.

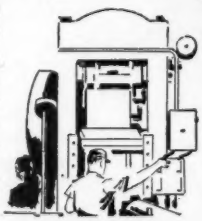

Wire Drawing

Oxalate Coatings for the stainless steels and many of the high-nickel alloys. These coatings are applied only by immersion process, and usually in a 5-stage system which includes an acid pickling or depassivating bath, a water rinse, the Amchem Granodraw SS coating bath, a hot borax neutralizing rinse for wire stock, or a lubricating bath for tube stock. Since thorough activation of the metal surface is necessary to promote an adherent coating, the pickling and activating bath is an important stage in processing.

Fluoride-type coatings for zirconium and its alloys. Granodraw ZR is such a coating. It is applied in an immersion process which includes precleaning, water rinse, pickling, water rinse, Granodraw ZR solution, water rinse, drying or lubricating. It has been used primarily in the treatment of stock prior to wire drawing and tube drawing. Surfaces are cleaned of oil and grease by solvent degreasing or alkali cleaning. Pickling is required to provide a surface that is chemically and metallurgically receptive to the coating.


Cold Heading

Amorphous phosphate coatings for aluminum. This type of coating is now in the development stage. Laboratory and field tests are being conducted, results are being evaluated, and modifications in chemical make-up and process sequence are being made to meet requirements. Several field tests, however, have indicated that it will do the same job for aluminum processors as the other types of coatings have done for those working carbon steel, stainless steel, high-nickel alloy, and zirconium.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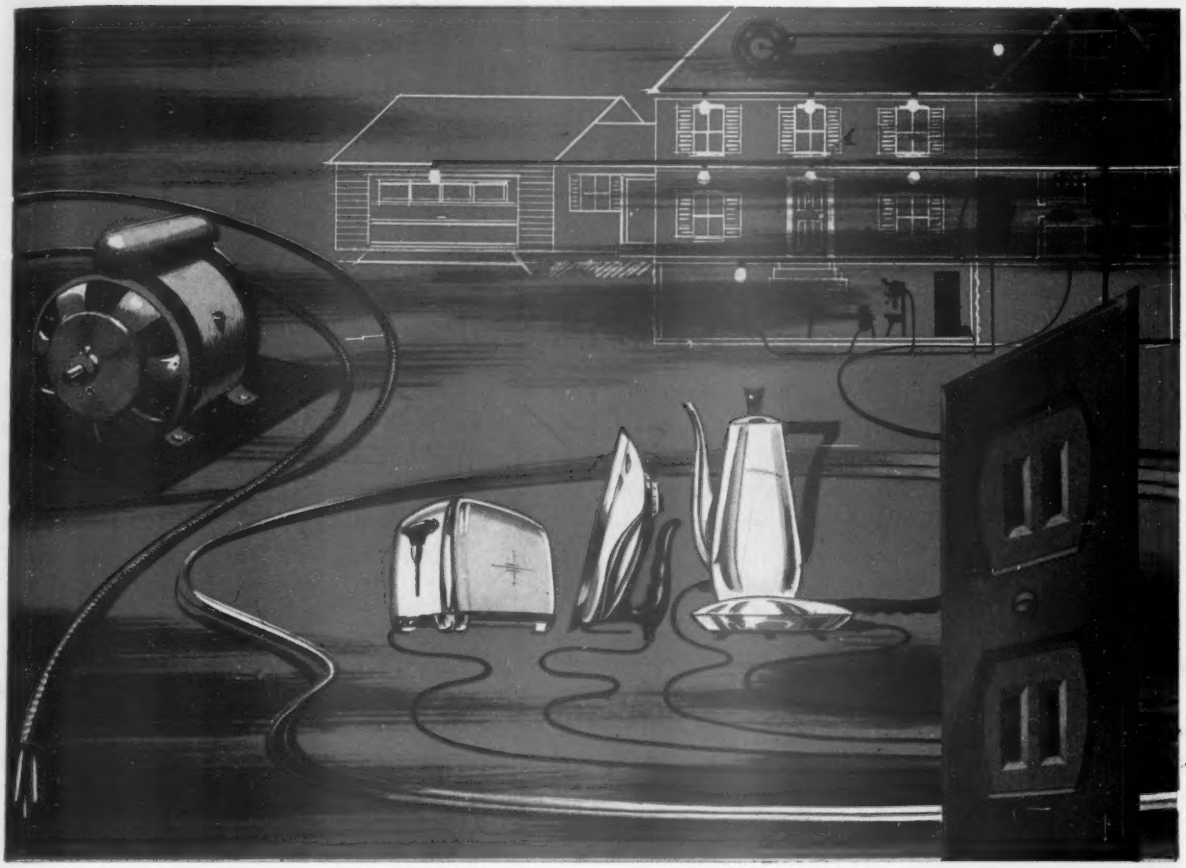

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Subscribers by Types of Mills in the Industry

1.	Rod, Bar and Wire (producers of rod, bar and wire in all metals and shapes)	38%
2.	Forming and Fabricating Plants (mfrs., largely from purchased wire, of springs, wire cloth, bolts, nuts, screws, rivets, wire forms, fences and fencing, wire specialties, wire rope and electric wire and cable)	59%
3.	Miscellaneous—Libraries, Research Organizations, Jobbers, Distribution, etc.	3%

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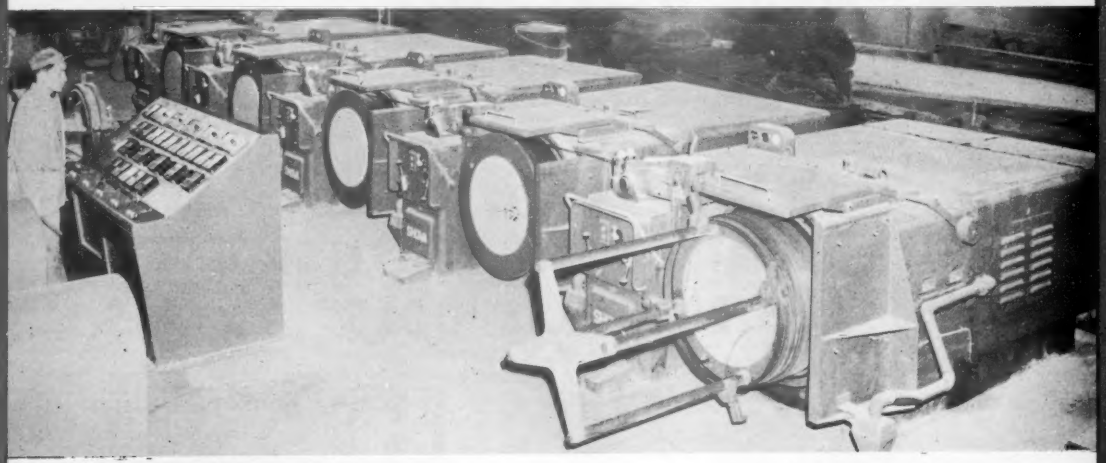

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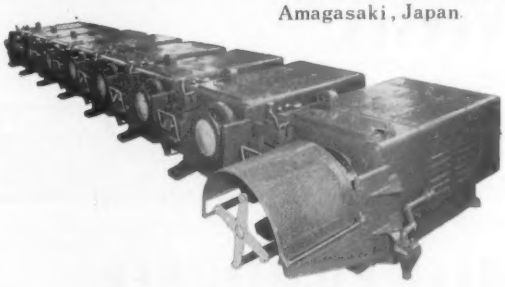
This installation photo shows the view of producing Prestressed Concrete Steel Wire at SHINKO WIRE CO., LTD, Amagasaki, Japan.

(by courtesy of Shinko Wire Co., Ltd.)



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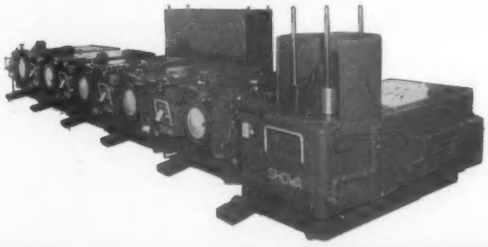

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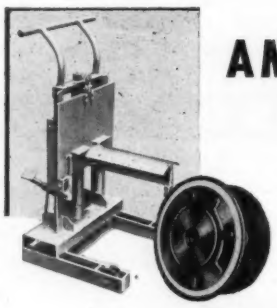

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The Wire Outlook

When will the steel strike end? This is the big question in the minds of industrialists. Besides the loss of millions in purchasing power of idle steel workers and many millions in sales for the producers, there have been serious repercussions in rail, shipping, coal and other industries affected by steel's shut down.

Granting that some wage increases will be conceded, both labor and companies have lost income that can never be made up. Time is all anyone has and what is done with it is of vital importance to general well-being.

The issues are not just a question of wages, since steel representatives hope in the final settlement to eliminate some of the union's limitations on work that will allow employers to secure an honest day's work for a day's pay.

A most important result of the strike should be the enactment of labor laws that will place the unions under the same anti-monopoly regulations that govern business. And while they are at it, our solons should also take steps to do away with racketeering, gangsterism, and all the other pernicious conditions that plague workers and industry alike.

It is well said that before we can enter upon a sound future, even if we prosper for the moment, the unions' monopoly powers must be broken. Otherwise we may be headed for a dictatorship of a type not far removed from those of Europe's past and some of its present. Should that happen, everything that is traditionally free and independent in America will disappear.

Currently business evidences great strength and vitality. And when the strike ends, renewed vigor and activity is expected to spur business on all fronts. Consumer confidence in the future is being demonstrated on a broad front. Employment has risen in construction, trade, services, resort, and amusement activities. While some of this is seasonal, it helps to tide over the strike situation.

The Federal Reserve Board is keeping the money supply low and interest rates high to the end of holding the line on inflation. While these measurements are intended to discourage borrowing, consumer and commercial loans have risen, the latter by $5 billion in the first half of the year.

The industrial fastener business is having a banner year, reported to be up over 40 percent. The industry nevertheless is beginning to feel the pinch of foreign-made products. While the total of imports now amounts to less than 5 percent of sales here, in one item — wood screws — 30 percent of the supply comes from other parts of the world. And the trend is up.

Wire orders have been fairly good and if the strike does not last more than 60 days, there should be no shortage of domestic supplies. August bookings were better than heretofore. Reinforcing fabrics for road building is an outstandingly good item.

The non-ferrous wire industry, notably brass mills, have received much encouragement from the trend of events, the wire end being reported to be up approximatly 20 per cent.

The fact that people are feeling better about spending means that more homes, cars, and appliances will be bought in the near future—all of which involve many types of wire and wire products.

Immediate threat of a big war has receded. We are again moving ahead. In the interim of improved outlook, let us not become complacent and neglect the long-range correction of our national problems.

Edmund Duval Sickels
EDITOR

WHEN IN CLEVELAND . . .

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Vol. 34 SEPTEMBER, 1959 No. 9

Modern Pickling and Yellow Pickling Plants

by Dr. - Ing. Eberhard Keetman
Chief Manager, Acid Proof Branch
Dr. Otto Saurebau u. Keramikwerke
Bendorf (Rhein), Germany

In this article the author has discussed mechanical equipment required for pickling, the regeneration of pickling baths, the heating of pickling tanks, the destruction of toxic vapors, and materials for pickling tanks.

Plants for pickling and yellow pickling are often considered as inconvenient departments in steel and metal works. While up-to-date construction is provided for production and transport equipment or for repair workshops, it is assumed that provisional equipment is sufficient for pickling and yellow pickling plants. The results are break-downs which reduce the efficiency of the plant. The loss of profit is often many times the investment required for modernization. In many factories it is understood today that surface treatment forms a part of the production process and requires up-to-date equipment. Therefore, a large number of pickling and yellow pickling plants have been modernized in recent years. When planning those plants, material handling has been mechanized wherever feasible, to obtain smooth operation.

Mechanical Equipment

For wire and strip material, continuous pickling plants (Fig. 1) are preferred. Stitchers and soldering machines transform the coils into endless strips which pass through the pickling, rinse and passivating baths.

At the end of the continuous pickling plant the strip is again transformed into coils which are fed by conveyor to cold rolling mills or to drawing benches. Strips and wires are also pickled before tinning and galvanizing. The strip material passes through the tinning or galvanizing bath after pickling and is then wound-up and cut, ready for shipping.

* * *

Special designs have been developed for factories where the available space is limited. In such

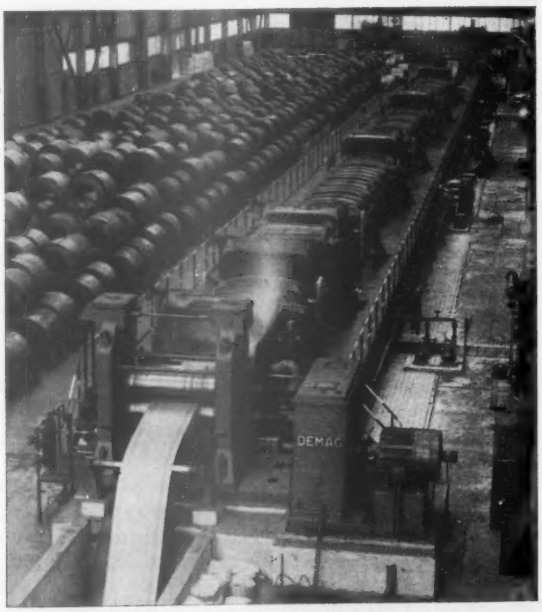


Fig. 1—Continuous pickling plant.

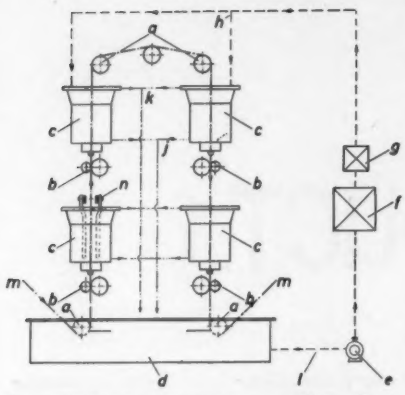


Fig. 2—Intensive continuous pickling plant for wires and strip material with vertical guide:
(a) guide roller, (b) guide rollers, (c) pickling tanks (d) collecting tank, (e) acid proof pump, (f) strainer, (g) heat exchanger, (h) pressure piping for the pickling, liquid (j) discharge piping, (k) overflow piping, (l) suction piping, (m) pickling material, (wire or strip), (n) electrode * * * * * *

cases the strip material passes through several tiered tanks (Fig. 2). The tank is entered from the bottom through a soft packing which lets a certain quantity of the pickling solution through. This pickling solution flows from one tank to the following, is collected in troughs in the floor and returned to the top tanks by centrifugal pumps.

* * *

This process is also applicable to galvanizing plants for tinning and coppering. In smaller factories, the following pickling process is used for strips not exceeding 12 inches in width. The coils are put into a perforated drum. The drum, the axle of which is horizontally arranged, is rotated in the pickling bath in both directions. The strip works in the drum like a watch spring. The coil is opened clockwise and closed counter-clockwise. Consequently, the pickling acid penetrates into the coils and effects uniform pickling. Application of this process is difficult with strip material of different widths. Construction of the pickling drum is complicated and expensive. If the ends of the strip material should stick to the guide device, the required movement of the strip will not be carried out. This will lead to pickling faults and consequently to scrap.

* * *

The decision as to which process should be used depends upon the local conditions and financial situation as well as upon the variety of the material to be pickled. Continuous plants are usually preferred for strip material. The continuous surface treatment is also used where possible, in factories with mass production of prefabricated goods. The equipment is usually adapted to the shape and size of the material.

* * *

Skelps more than 63 inches in width are pickled according to a patented process. The coils, hanging from pickling hooks are guided through the pickling bath by means of a chain. At the top of the pickling tank, they are discharged and pass vertically through a rinse tunnel with spray nozzles, and then through a drying tunnel. Pylon pickling plants (Fig. 3) are also practical for large skelps. In these plants, pickling

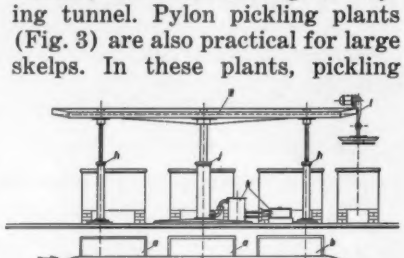


Fig. 3—Pylon stroke pickling plant for small pieces. * * * * * *
(a) spray pickling tank, (b) cold rinse tank, (c) hot rinse tank, (d) chromic acid tank, (e) cold spraying tank, (f) entrance and exit of the pickling material, (g) travelling path with up-and-down stroke, (h) guide column, (j) working cylinder, (k) oil pressure equipment, (l) self-acting transport equipment. * * * * * *

baskets, fixed to chains, are dipped into the tanks one after the other. In general, two pickling tanks, a rinse tank and a passivating tank are necessary to get the required pickling times. Parts of vehicles and other shaped pieces are fixed to a conveying chain and passed through a treating tunnel in which they are sprayed with pickling solution, rinse water and passivating solution. Generally, a drying section is annexed. The choice and design of the conveying chains and the working tunnel demands much care on the part of the designer, if failures are to be avoided.

* * *

Besides the tunnel spray pickling process, stroke pickling is used for shaped pieces if many different baths are necessary. Automatic stroke plants are especially preferred when pickling is followed by a galvanic surface refining process. Depending on local conditions, the pickling material is fed to the various baths by means of a lifting beam or a circular conveyor with hydraulic lifting motion (see Fig. 3).

* * *

Small pieces can be treated in drums. Spiral vaults effect the conveyance of the goods in the rotating drums. Such automatons can only be used for mass products of uniform size.

* * *

Compared with the mechanized pickling processes, the pickling plants for mass products, operated by hand or crane, are not economical due to the high labour costs. They are used in special cases only. In these plants, the goods are moved in the pickling tank, or else the pickling liquid is circulated in order to reduce the pickling time and eliminate surface defects.

* * *

Swing apparatus of various designs are used to move the material in the pickling bath. If great lifting heights are required, stationary balancing machines with one or two arms are used. The pickling baskets, fastened to brackets, are dipped into the pickling bath, removed and transported by overhead crane. With smaller lifting heights up to 3 inches, a modern apparatus, the pickling tilter with electric hoist (Fig. 4), may be used. This apparatus com-

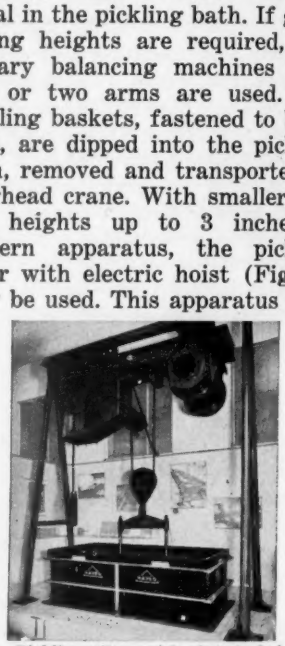


Fig. 4—Pickling tilter with electric hoist system Otto. * * * * * *

bines an electric hoist and a swing device and is used for dipping, removing, transporting and agitating the material in the baths. Pickling tilters with loads up to 11,000 lbs., have stood the test with difficult pickling problems. They are used for pickling wire and coils, ribbed pipes and rods, skelps and hearth pieces.

Pipes and rods are tilted in the bath with moving chains. By continuous movement and by lifting above the level of the pickling bath, all surfaces are uniformly wetted, so that surface defects are avoided. Transport to and from the pickling tilter is accomplished by overhead crane.

Regeneration of the Pickling Baths

Besides the mechanical equipment, the pickling bath is of decisive importance to the efficiency of the plant. Modern continuous plants demand a uniform composition and a constant temperature of the baths for faultless operation. To obtain a short contact time of only a few minutes, high acid concentration and pickling temperature is obsolutely necessary.

* * *

Treatment of spent pickling solution is no longer a problem for sulphuric acid pickling solutions (Fig. 5). In steel pickling plants, the iron sulphate is concentrated to 3.5 lbs./Imp. gal. ($FeSO_4 . 7H_2O$) which corresponds to a content of .70 lbs. Fe./Imp. gal. This solution passes a cooling apparatus in which ferrosulphate (Vitriol) precipitates in the form of crystals when the limit of solubility is passed. Generally, cooling to 40-50°F is sufficient to obtain a Vitriol content of approximately .70 lbs. Fe. /Imp. gal. in the pickling bath. The crystals are separated from the mother liquor and stored. The mother liquor is brought up to the desired acid concentration by addition of cold rinse water and concentrated sulphuric acid, and is returned to the pickling tank in counter-current to the pickling material.

* * *

Figure 6 shows a crystallizer, a cooling device for pickling solutions which requires low investment and labour costs. At the top of the cooling apparatus the spent pickling solution is fed to a distributor from where it runs in a thin film down the interior wall of the vertical, thin-walled cooling pipes of synthetic material. A fan arranged at the distributor exhausts air in counter-current to the pickling liquid. Additionally, the outside surfaces of the cooling pipes are cooled with water. Thus, cooling is effected by removal of heat and evaporation of the water portion which is taken up by the air. More intensive cooling, required for extensive separation of the iron sulphate, is obtained by direct brine cooling.

* * *

Fig. 6—Crystallizer Otto-Intos system.

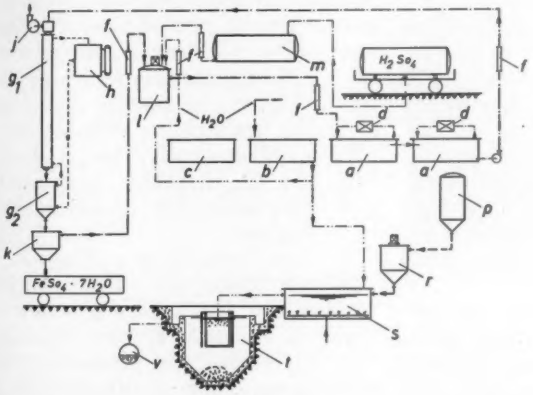


Fig. 5—Pickling plant with recovery and neutralization plant. * * * *
(a) pickling tank, (b) rinse tank, (c) passivating tank, (d) pickling bath heating, (e) pump, (f) flow meter, (g) crystallizer with precooler and secondary cooler, (h) refrigerator, (j) fan, (k) centrifuge, (l) mixing and proportioning tank with agitator, (m) storage tank for H_2SO_4, (p) storage tank for neutralizing agent, (r) proportioning tank, (s) mixing and venting basin, (t) settling tank with feeding distributor, (v) canalization. * * * *

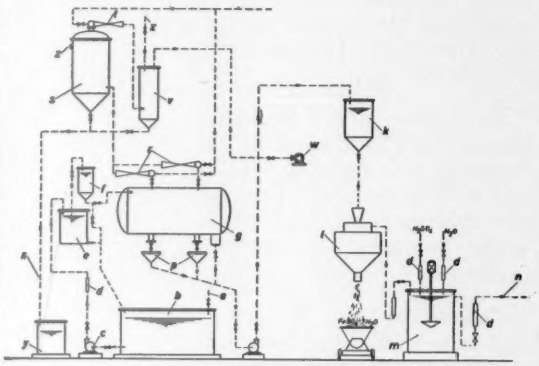


Fig. 7—Vacuum crystallization plant.
(a) feed from the pickling plant, (b) collecting tank, (c) pump, (d) flow meter, (e) work tank, (f) precooler, (g) crystallizer, (h) regenerated acid outlet, (j) salt sludge pump, (k) feed tank, (l) centrifuge, (m) mixing and proportioning tank with agitator, (n) return to pickling plant, (p) discharge devices, (q) live steam feed piping, (r) high-efficiency steam jet apparatus, (s) condenser, (t) vent steam jet apparatus, (v) auxiliary condenser, (w) vacuum pump, (x) condensate discharge piping, (y) pressure compensating tank, (z) cooling water feed piping. * * * * *

If cheap saturated steam is available at 100 psi pressure, vacuum cooling crystallization may be economical. (Fig. 7). The spent pickling solution is cooled in several stages to 40-50°F by removal of evaporative heat by means of steam jet exhausters, and the mother liquor is separated from the Vitriol crystals in a continuous centrifuge. By influence of heat, the resulting iron Vitriol ($FeSO_4 \cdot 7H_2O$) can be manufactured into monohydrate ($FeSO_4 . 1H_2O$) which is roasted in a fluid bed calciner to SO_2. Thus the sulphuric acid content of the Vitriol can be recovered. Attempts to release the sulphuric acid from the Vitriol by conversion with muriatic acid gas have led to no practical results to date.

* * *

Treatment of muriatic acid-containing pickling solutions from

steel pickling plants has been of no importance up to now, as muriatic acid now used in few factories prior to surface refinement. (tinning, galvanizing, enamelling). They confine themselves to enriching the pickling solution as much as possible with perchloride of iron and selling it to earth colour factories. Continuous pickling plants use the cheap sulphuric acid almost exclusively. (In an aluminum strip pickling plant, a muriatic acid regeneration plant is at present in operation, on approval. The muriatic acid is evaporated by direct heating; the vapours are condensed by indirect water cooling. The results have not yet been published).

* * *

In copper and brass pickling plants there is a possibility of recovering the copper by electrolysis and returning the sulphuric acid to the pickling plant. Such plants are under operation in some larger factories.

* * *

Copper can also be precipitated and removed from concentrated pickling solutions as cement copper by means of scrap iron in acid solution. (Fig. 8). Ion-Exchange processes are still being tested. With regard to the high toxic effect of

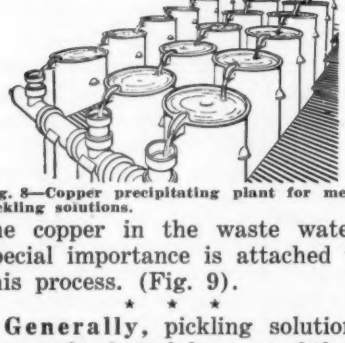


Fig. 8—Copper precipitating plant for metal pickling solutions.

the copper in the waste water, special importance is attached to this process. (Fig. 9).

* * *

Generally, pickling solutions from refined steel, because of their complex composition, are not separated but are neutralized and desalted with milk of lime.

* * *

In galvanic plants the treatment of the pickling waste waters is also discouraged. Usually, the concentration of the alcaline baths is so great that by addition of small quantities of milk of lime the p^H of the mixed waste waters is high enough for the precipitation of salt.

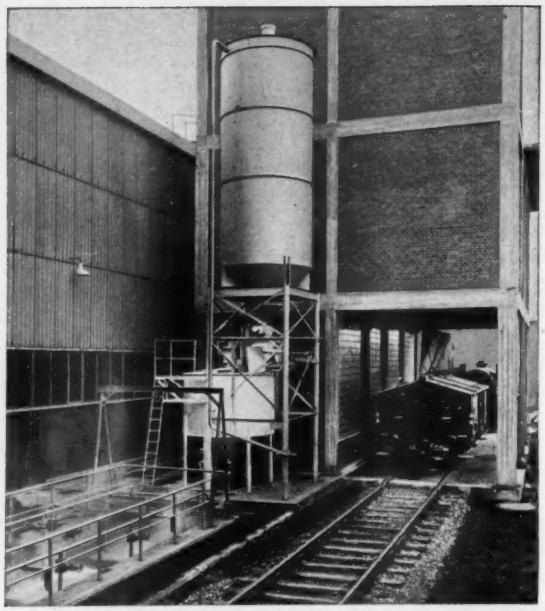


Fig. 9—Continuous neutralization plant with lime milk upgrading.

* * *

In steel pickling plants today, only the acid rinse waters from the cold rinse, flowed through by water, should be neutralized. It is uneconomical to neutralize spent pickling liquid with milk of lime. According to the enquiries made by the Ruhrverband about 70 cents per ton of pickling materials are spent for neutralization in steel pickling plants. Procuring of a treating plant would save a high percentage of the neutralization costs. The treating costs, including the amortization costs, are offset by sulphuric acid savings. Neutralization of the acid rinse water in a continuous plant requires only small expenditures for wages, chemicals and power. The reaction follows the addition of milk of lime between p^H 8 - 9, under ventilation. The precipitating slime of gypsum and the coarse-flaked, red-brown iron hydroxide are clarified in a connected mechanical clarifying plant. The slime which deposits at the bottom of the settling basin as periodically removed.

* * *

Insofar as they are required today, intermittent neutralization plants usually comprising two or more basins, which are alternately filled, are used only for treating concentrated waste waters from pickling plants. It is advisable, however, to collect the waste pickling solutions and to add them continuously to the rinse water current. Then neutralization can be effected in a continuous plant with low labour costs. Special steps must be taken, however, if the iron content in the waste water exceeds a certain value, in order to guarantee the conversion of the fine green ferrohydroxide to well clarified, coarse-flaked, red-brown ferrihydroxide, $Fe(OH)_3$, by ventilation.

Heating of the Pickling Baths

Special problems will arise when pickling is to be undertaken at higher temperatures. In general, muriatic acid, refined steel mixing and yellow pickling solutions are used with normal temperatures. If these highly aggressive pickling solutions are heated, difficult corrosion problems will arise. A short life of the heating equipment should be taken into consideration in such cases.

* * *

The introduction of saturated steam into the pickling solution which is still used in many plants, is the cheapest and simplest kind of heating. If the quantity of condensate exceeds the quantity of water evaporating at the surface of the bath and sticking to the pickling material, the bath is liquified and losses are caused by discharge of liquified pickling solution into the waste water.

* * *

In modern plants, heating is totally or partially accomplished in

the indirect way by steam or gas. At present, steam heating can be effected by graphite block heat exchangers (Fig. 10) which have stood the test with sulphuric acid pickling solutions from steel pickling plants. For heating of sulphuric acid pickling solutions with gas, the heating apparatus shown in Fig. 11, which operates with a transfer medium of boiling oil circulated by a pump, has been developed. The exchange surfaces are of evenly leaded steel plate and have a very long life due to the moderate exchange temperatures. For smaller pickling tank volumes electrical immersion boilers are used.

* * *

With indirect heating and use of a regeneration plant it is absolutely necessary to circulate the pickling solution. The advantages for the pickling process are considerable and justify the costs entailed. The constant composition and temperature as well as the violent agitation of the bath in the heating cycle accelerate the pickling process and avoid surface defects.

Destruction of Pickling Vapour

The toxic vapours developed during pickling must be exhausted and destroyed. Open tanks up to 4 feet in width are equipped with rim exhaustion at both longitudinal sides (Fig. 12).

* * *

With larger pickling tanks, a veil of air is blown over the surface of the bath from one longitudinal side in order to lead the vapours to the vents at the opposite side.

* * *

In continuous plants, the tanks are equipped with covers (Fig. 1) to which the suction pipes of the exhausting plant are fixed. For inlet and outlet of the material to be pickled, the respective opening is made as small as possible and is also covered with rubber cloth, in order to hold down the required air capacity of the exhausting plant. In plants with manual operation, the covers are provided with a working opening at the front side. The front is a hinged cover, equipped with transparent squares of synthetic material.

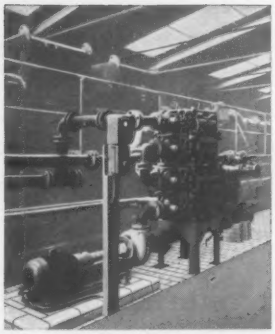


Fig. 10—Graphite block heat exchanger.

Fig. 11—Simplex-Heating device for long distance gas heating. * * * *

Fig. 12—Pickling tank with rim exhaustion at both longitudinal sides. * * *

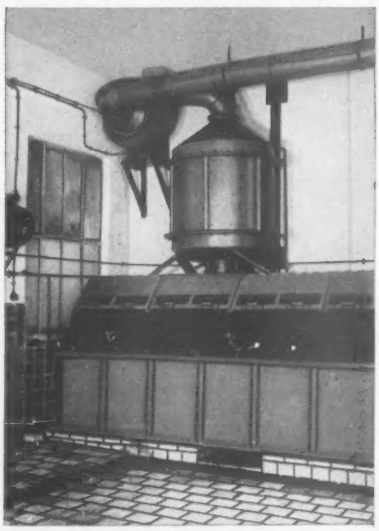


Fig. 13—Yellow pickling plant with waste air destruction plant. * * * *

The acid-containing waste air is either blown off through acid chimneys as high as possible or better, scrubbed with water or liquified lye in gas filters of a destruction plant (see Fig. 13). Special steps are required for nitrous gases. According to the Nitrosol Process, the waste gases can be oxydized-up with active charcoal, transferred into ammoniacal compound by chemical scrubbing, and then removed from the waste air.

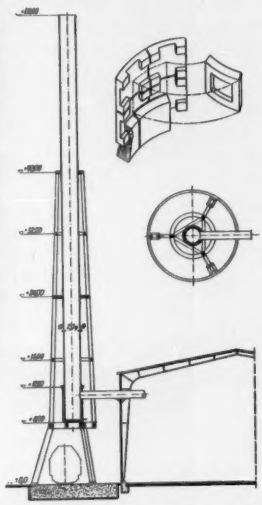


Fig. 14—Waste gas chimney executed in the Otto-Duolith-brick bond. * * * (Right-hand top corner: section of the "DUOLITH-brick bond. Below: plan of the chimney. The height is given in meters.)

Material for Pickling Plants

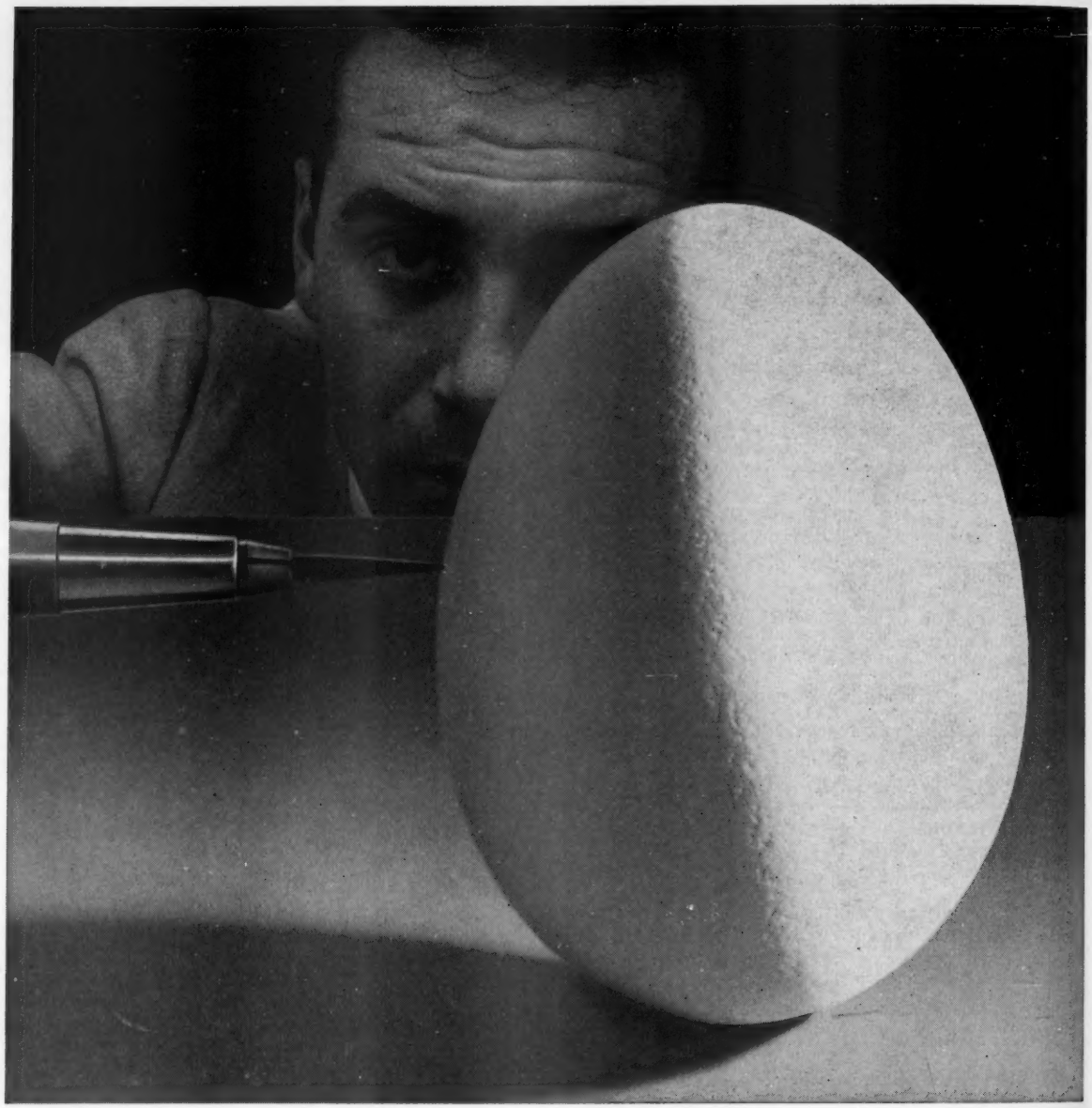
In modern pickling and yellow pickling plants all parts in direct contact with acids are of corrosion proof construction. Tanks are made entirely of the synthetic resin material HAVEG, of the synthetic resin material Bendurplast, of manufactures having a Polyester base, or of Vinidur. If there is considerable mechanical stress, the tanks are made of reinforced concrete or steel plate with acid proof lining comprising acid proof protective layers and tiles.

* * *

Pipings, pumps and blowers must be of corrosion proof design. For liquids, HAVEG pipes are preferred because of their high resistance to acids and high temperatures. Vinidur pipe is useful for mixtures of nitric acid with temperatures up to 140° F.

(Please turn to page 1151)

A delicate problem . . .



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Bethlehem's Induction Heated Stress-Relieved Strand

by Robert F. Joy
Engineer - Development
Research Department
Bethlehem Steel Company
Bethlehem, Pennsylvania

In this article the author describes a process developed by his company that enables them to attain reproductible and uniform mechanical characteristics between different reels of strand.

After several years of extensive research, Bethlehem Steel Company has perfected a unique method of stress-relieving strand for prestressed concrete by induction heating. Manufacture of the strand and heat treatment is accomplished in a continuous in-line operation. Stress-relieving temperature is maintained within close limits, thereby producing strand with constant and reproducible mechanical characteristics.

* * *

Bethlehem installed a new multi-block drawing machine of the most modern design to insure the best possible wire since strand is only as good as the wire from which it is fabricated. Wire is drawn from coils of rods of carefully controlled analysis. Seven heavy-weight coils of wire are carefully spooled onto bobbins to achieve the production of long lengths of strand. As an example, 15,000 feet of 3/8" diameter strand can be produced in a continuous length.

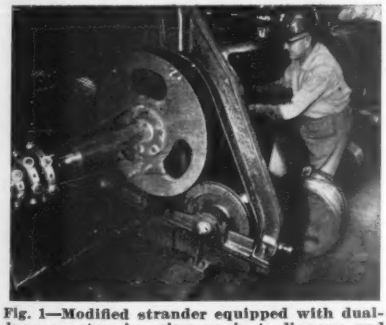

Fig. 1—Modified strander equipped with dual-drum capstan insuring against slippage and maintaining the strand tension required for the stress-relieving operation. * * *

The strander shown in Figure 1 has been modified as follows:

(1) a two-drum capstan or haul-off mechanism has replaced the single-drum capstan customarily used. Four wraps of strand are taken around the dual-drum capstan to insure against slippage and maintain the strand tension required for the stress-relieving operation.

(2) A positive infinitely variable transmission has replaced the gear drive. This arrangement allows for changing lay length on any particular diameter strand and for changing from one size strand to another without changing drive gears. Thus, the most favorable lay length resulting in the best mechanical characteristics for each size strand can be selected and controlled accurately.

* * *

From the capstan the preformed strand passes over a series of sheaves capable of retracting a substantial length of strand back through the induction coil. Such an arrangement is required for starting and stopping for reel changes.

* * *

Next the strand passes through an air jet, a water quench station, and over a set of guide rolls located at the entrance of the induction coil. When the strand is moving in the forward direction to the induction coil and reel stand, this water quench station is not in operation. Only upon retraction of the strand does this water quench operate.

* * *

The induction coil is approximately 7/8" inside diameter and about 34" long. The water-cooled induction coil with the protective asbestos covers removed is shown in Figure 2. Power is supplied to the coil from a 250-kw, 10,000-cycle motor-generator set operated from a 440-volt 3-phase line. The maximum rated output voltage is 800 volts. For 3/8" diameter strand at top manufacturing speed, approximately 450 volts are required.

* * *

As line speed is reduced in starting and stopping, the input voltage

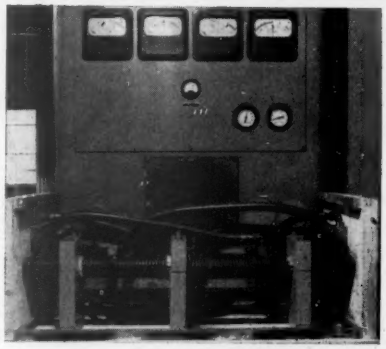

Fig. 2—Water cooled induction coil with protective cover removed. * * * *

to the coil is automatically reduced in order to maintain a constant strand temperature. Voltage control is primarily achieved by a positive drive tachometer generator connected to one of the capstan drive shafts. The signal from this generator is fed into a voltage regulator which in turn controls the power input to the induction coil. This tachometer generator supplies the major temperature control at operating speeds.

* * *

Immediately at the exit end of the induction coil is a shielded radiation pyrometer sighted on the strand. Temperature recorded by this pyrometer supplies a signal to an "Electr-O-Volt" control unit which acts as a vernier adjustment and check of the temperature established by the tachometer generator. At operating speeds, the stress-relieving temperature is maintained within close limits. This precise temperature control is of major importance in assuring strand having identical properties, reel after reel. Figure 3 is a typical temperature record taken dur-

(Please turn to page 1153)

Epocast Terminated Wire Cables

by John Delmonte
General Manager
Furane Plastics, Inc.
Los Angeles, California

In this article the author has described a new method of terminating wire rope.

The attachment of wire rope and cables may be greatly facilitated through encapsulation and bonding at their terminals with appropriate epoxy resin formulations. This practice has proven very valuable to various marine installations and public works projects entailing considerable usage of wire rope. The basic reasons for the soundness of this method of attachment lie in the excellent adhesion demonstrated by some epoxy resins for metals and their negligible shrinkage used in conjunction with wire ropes.

* * *

Illustrated in Figure 1 is a typical Epocast wire terminal kit, collar and attachment to a wire rope. It is particularly significant that all destructive tensile tests result in failures in the wire cable rather than in pull-out or rupture within the collar. This consistently unique performance enables designers to adopt simplified and more positive attachment means for wire products. Instead of the earlier mechanical measures of rigid mechanical clamping at cable terminations, a far superior mechanical join ensues when Epocast resins are used—due not only to the adhesion but also to the penetration through all of the individual wires to achieve a complete adhesive interlocking of all structural elements.

* * *

The handling and application of Epocast wire terminal materials are accomplished with relatively little experience and practice. In general there are two components to be used, the plastic component and the hardener component. Kept apart, these materials will remain useable indefinitely. Blended together by mixing they will react chemically and harden without the use of external heat. This means that melting pots and blow torches

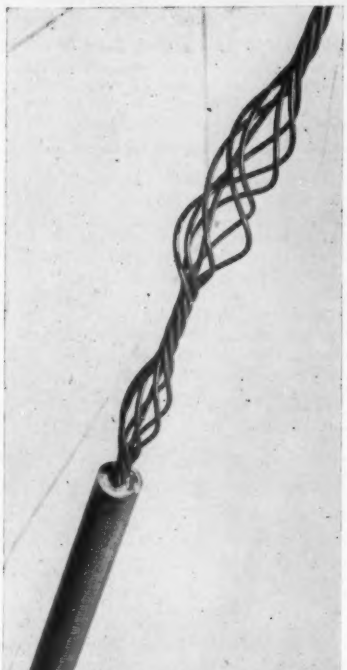

Fig. 1—Epocast 4D/9615 may be used to pot, seal, and bond to wire rope terminals.

hitherto used for melting metal alloys in the field, can be eliminated from the service kit insofar as soldering or potting wire rope terminals with metals is concerned.

* * *

Another important consideration is the character of the curing agent and the epoxies applied to the surfaces of metals. There are no acid catalysts or fluxes employed. As a matter of fact, the amine type curing agent employed with room temperature curing materials may serve as a corrosion inhibitor.

* * *

Because epoxies are capable of curing at room temperatures of 70 to 100°F, field application is simplified considerably. However, the time required for developing optimum adhesive strength is a function not only of materials, but also of prevailing temperatures. If temperatures are too low (under 60°F) too long a time may elapse before full strength is achieved. For cold weather installations external heat is advisable to hasten the cure of Epocast terminal kits. Temperatures of the order of 150° to 200°F for thirty to forty minutes should suffice. Otherwise left overnight at 70 to 100°F adequate bond strength is developed.

* * *

Room temperature curing Epocast formulations may also provide their own heat to complete their cure more rapidly. For example, the exothermic temperature rise in a one-pound container may be to a temperature as high as 230°F. This temperature developed is a function of resin mass and hardener, and much lower temperatures are devoloped when the heat sink of the wire cables themselves are present.

* * *

Practical use is made of the temperature rise by the marine industry. For example, it is a practice to pot the ends of cable terminals as in Figure 2 by fraying out the wire ends after insertion into an appropriate yoke or collar. After sealing the opening with Epocaulk, the Epocast wire terminal compound is poured into the collar. Temperature rise during the beginning of cure is usually sufficient to achieve good strength within the hour. Wire ropes terminated in this manner demonstrate strengths and serviceability more than equivalent to the low melting metal alloys hitherto used. Better stress-corrosion resistance is also exhibited by Epocast potted cable terminals. Instead of contributing to increased corrosion rates due to contact difference of potential between dissimilar metals, the plastic will seal and insulate

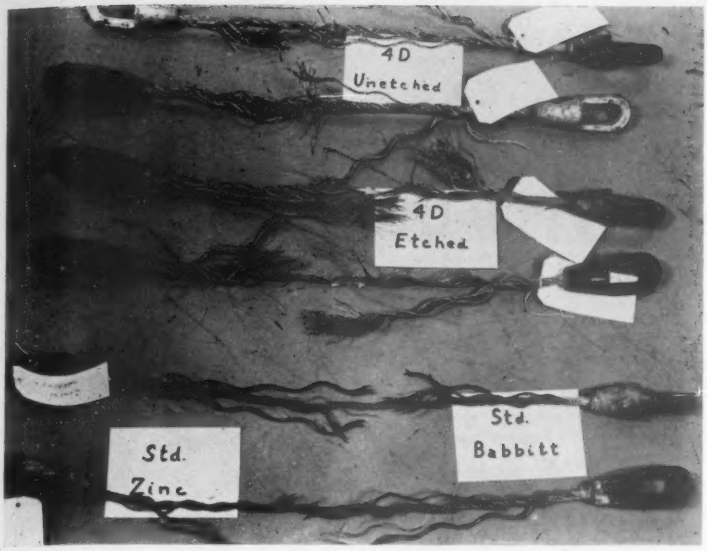

Fig. 2—Ends of cables frayed out after being potted in cable terminals. * *

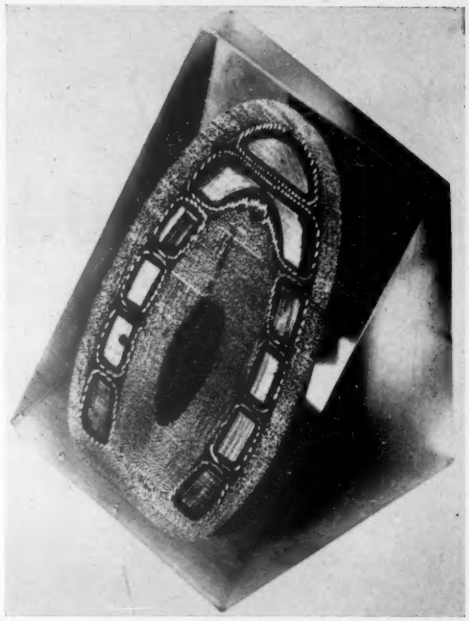

Fig. 3—Toroidal coil completely encapsulated in Epocast 202/D-40. * * * * * *

against corrosive influences. Under industrial atmospheres and sea water exposures, enhanced resistance to corrosion is an important feature.

* * *

Although in this paper the new technique of sealing wire cable terminals has been emphasized, design engineers would have a better grasp of the mechanical advantages of these systems, with data on the physical and electrical properties of the material by itself —unreinforced with high strength wires. This data is assembled in Table I:

* * *

Where high fluidity and maximum penetration is required, there are other compounds available. For example, in Figure 3, a cross-section is shown of a tightly wound toroidal coil, indicating complete penetration by Epocast formulations. Potting and encapsulation of electrical and electronic apparatus will frequently require extensive use of epoxy resins to penetrate into and to seal wire-wound components.

* * *

In the adaptation of epoxy resins to wire and wire products we are experiencing an improvement in design latitude and enhanced performance. The attachment of wire products to metal structures becomes a simplified design procedure with these newer epoxies.

TABLE I

Physical and Electrical Properties of EPOCAST* Wire Terminal Compounds

Adhesion to Steel	Shear Strength	2000 p.s.i.
Adhesion to Copper	Shear Strength	1500 p.s.i.
Adhesion to Aluminum	Shear Strength	2000 p.s.i.
Ultimate Tensile Strength		5000 p.s.i.—
Ultimate Compressive Strength		16,000 p.s.i.
Modulus of Elasticity		200,000 p.s.i.
Density	1.35	
Shore D Hardness at Room Temperature		84/82
Shore D Hardness at 150°F.—	72	
Volume Resistivity	10^{15} ohm-cm.	
Arc Resistance	120 secs (ASTM)	
Dielectric Strength		400 volts per mil

* Data at 75°F and ASTM tests used unless alternative indicated. Epocast 4D plus 302. HN9615

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The Program

On Monday afternoon a Joint Technical Session will be held at which Awards for 1958 papers will be made, certificates to those who have become 25-Year Members presented, and the Mordica Memorial Lecture given. This will be followed by two papers of general interest and a motion picture.

Three simultaneous technical sessions will be held on Tuesday and Wednesday for the Ferrous Division, Non-Ferrous Division and Electric Wire and Cable Division.

On Wednesday evening, following the banquet, an after-dinner address will be made by Dr. Jason J. Nassau on astronomy and its relation to the guided missile program and space travel. Don't miss this talk!

Thursday will be devoted to a plant tour of the Cuyahoga Works of the American Steel and Wire Division of United States Steel Corporation.

Many other program features will make the 1959 Convention the most important one yet held.

Meanwhile, make your plans to attend.

Reservation cards available upon request.

THE WIRE ASSOCIATION

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Fabrics for Electrical Heating

by Thomas A. Dickinson
Los Angeles, California

The fabric heating elements described in this article may incorporate any of a number of metals or alloys, depending on the heat required in different applications.

Copper and chrome-iron alloys are typical examples. The object of the article, however, is not to discuss the heating elements as to metallurgical formulations, but as to the novel manner in which they are used.

Cloth-like materials, made by interweaving fine wires and nonconductive fibers, are currently being used in the fabrication of custombuilt electrical heaters at **Electrofilm, Inc.**, North Hollywood, Calif.

* * *

The fabrics are produced as strips of tape with widths ranging from ¼" to 2" and lengths up to about 5'. They have 36 wires per inch of width for longitudinal current flow; 30 wires per inch of length, perpendicular to current flow, for the distribution of power in the event one or more longitudinal conductors are broken or damaged. Advantages of this arrangement have been demonstrated

Fig. 2—Incorporated in rubber blankets, mesh-type heating elements can serve as basic components of detachable or general-purpose heaters.

by tests which showed that fabric-type elements could produce heat without a great loss of power when all of the main conductors were at different points severed!

* * *

Non-conductive fibers in the tapes serve the purpose of imparting strength to metal wires, and two general types are being used for different applications — nylon or plastic materials being preferred where temperatures will not exceed 500°F.; glass or ceramic fibers, where temperatures range upward to 2000°F.

* * *

Methods of using the tapes as heating elements are variable. For

Fig. 1—Fabric-type heating elements being aligned for use as coring in laminated cabinet panels that will be integrally heated.

example, they can be incorporated in a blanket for general-purpose heating operations; or they can be impregnated with resinous binders and laminated to parts or tools requiring permanent or integral heating elements.

* * *

Standard electrical terminals and thermostats are used in a more or less conventional manner to obtain specified temperatures in the fabric-type elements, which have the primary advantages of being extremely light (weighing from about 0.1 to 0.5 lbs. per sq. ft.).

* * *

Resistances of the elements range from 1100 ohms per inch to 0.7 ohms per foot of length, and dielectric tests have shown they are respectively suitable for use as follows:

(a) 650 votls RMS, AC, for one minute in 28 volt applications.

(b) 1250 volts RMS, AC, for one minute in 110 volt applications.

(c) 100 megohms per sq. ft. for 500 volt DC applications.

* * *

Compared with older electrical heating elements, wire-mesh heaters are desirable to the extent that they can minimize power consumption by permitting maximum heat transfers to large and irregular surfaces with a high degree of uniformity. Incorporated in dies, for example, they can eliminate the alternate hot and cold areas which usually make the integral electrical heating of tools objectionable.

* * *

In new products, tape-type elements are doing much to improve appearances as well as operational characteristics. Water heaters used in making coffee aboard commercial airliners, for instance, now look and perform better because they use heat from fabric strips

Fig. 3—Cloth-like tape for heating element in a dome-shaped heater is positioned so that it can be laminated between two insulating layers of plastic-impregnated glass fabric.

laminated to more than 50% of their external surfaces.

* * *

Similarly, cabinets used by medical technicians are able to maintain blood specimens in better condition because they have panels with integral elements for the uniform heating of all internal areas.

* * *

According to Electrofilm engineers, no special skill is required to install tape-type heating elements. However, substantial revisions may have to be made in current industrial heating concepts in order to take full advantage of their potentialities.

A New Method of Joining Wires by Brazing

New ideas are the essence of progress. The method of joining wire by brazing described here is a contribution to better wire.

A new system for electric brazing solid and stranded wire—particularly copper wires—has been developed by **Maurice G. Steele,** development engineer of **Rome Cable Corporation.** A U. S. patent has been awarded to Steele and assigned to the company.

* * *

The advantages of the process are: Stronger brazes than were possible previously, minimum length of stiffened wire, minimum annealed length, and no distortion of wire shapes during the brazing operation.

* * *

Steele's system centers around the use of two opposed mechanical metal clamps, one on each side of a standard carbon-block brazer using opposite electrodes. One, a fixed clamp, is separated from the electrode by a small air gap of approximately 1/64 inches. The other is a spring-action sliding clamp designed to move horizontally in line with the electrode groove and towards the other clamp.

* * *

To braze, one wire is inserted in the fixed clamp, so the wire end extends nearly halfway through the groove in the adjacent lower electrode. A small pellet of brazing metal is placed in the groove adjacent to the wire end.

* * *

The other wire is placed in the sliding clamp so it lies in the lower electrode with the end touching the opposite end of the brazing pellet. A stop device holds the clamp about 1/32 inches from the electrode.

* * *

Next, the upper electrode is lowered to enclose both wire ends and the brazing pellet. Pressure on the sliding clamp is released so it presses one wire end against the pellet and in turn, the pellet against the other wire end.

* * *

Current is applied and the spring action of the sliding clamp causes one wire end to move through the electrode groove towards the other wire end as the pellet is melted. A strong brazed joint is formed where the wire ends meet.

* * *

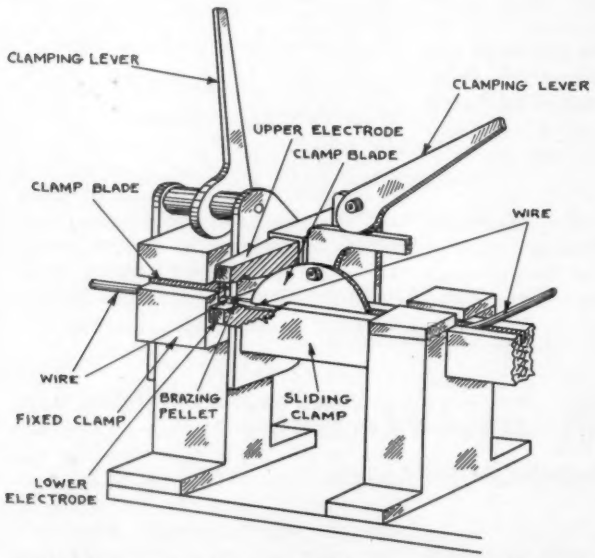
The accompanying drawing illustrates the manner in which the two wire ends are held in position in the lower electrode on either side of the brazing pellet prior to lowering the upper electrode.

* * *

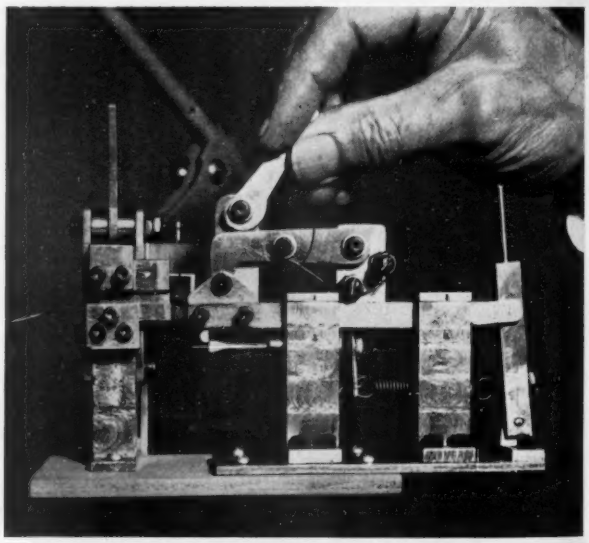
The spring clamp may be adjusted to prevent excessive pressure from bending the wire strands when pressed together. Also, because the electrode grooves and clamps hold the wires firmly in place, they cannot "balloon."

* * *

Further, because the clamps are close to the electrodes the wires are "chilled" and annealing is restricted to the short length of wire between the electrodes. The clamps, because of their "chilling" action, also prevent wicking of the solder from the braze area. In turn, less wire is stiffened so that a high degree of flexibility is retained. Chances of mechanical failure are considered to be much less because of the stronger brazes possible with the new method.

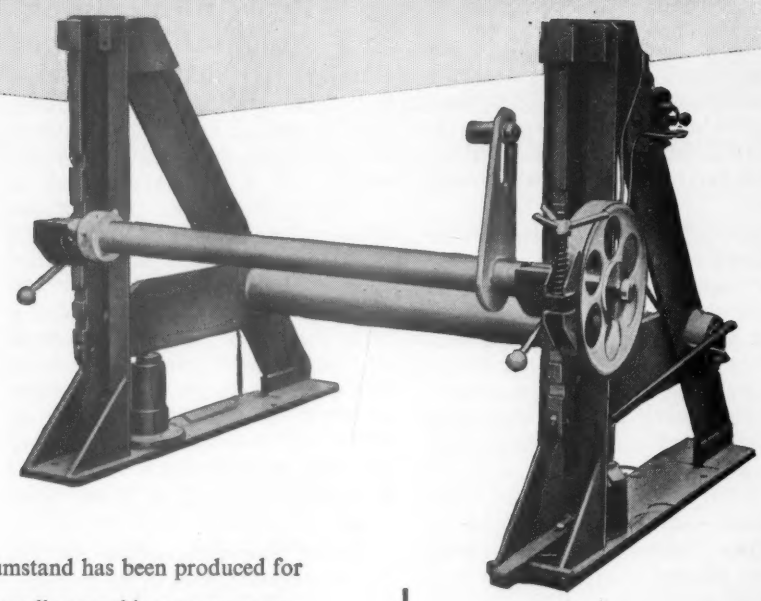


Plan drawing of brazing device showing manner in which the ends are positioned for the brazing operation. * * *



Two opposed mechanical metal clamps, one on each side of a standard carbon-block brazer using opposite electrodes, are keys to a new system of brazing solid and stranded wires developed by a Rome Cable engineer. * * * * * * * *

THE *NEW*
HYDRAULIC PAY-OUT DRUMSTAND



The new LB Hydraulic Pay-Out Drumstand has been produced for quick adaptation for use with any stranding machines to carry an additional stranded core or lead-in wire. It is ideal for extruding lines. All loading operations have been simplified. The support bearings carrying the through shaft are easily positioned ready for lifting the drum clear of the floor. Hydraulic jacks do the lifting and lowering. The tensioning device is independent of the through shaft to avoid constant dismantling. The Drumstand is made in five standard sizes to meet a variety of drum diameters up to 10 feet and weights to 10 tons. To increase the diversity of application each stand is supplied with two shafts of differing diameters.

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LB.8

Telephone Exchange Area Cable Insulated and Jacketed with Polyethylene

The properties and economics of polyethylene leading to this trend are described in this article.

The past five years have seen growing evidence of a significant shift by the telephone industry to the use of polyethylene for both insulation and jacketing of outdoor cable. The action reflects a re-evaluation of polyethylene by cable engineers. Once valued solely for its excellent electrical properties by cable designers, polyethylene has won increasing acceptance as a tough, permanently flexible sheath for outside wire and cable.

* * *

Until 1951, much of the multiconductor telephone cable was made with paper insulation and lead sheath surrounding the wires. At about that time, however, indications of a slowly developing shortage in the world's lead supply forced a search for new materials to maintain this vital communications service.

* * *

Cable manufacturers, such as **Whitney Blake Company,** New Haven, Conn., began to try out various plastic materials for the job. One of the most promising was polyethylene, which was first introduced commercially in this country by **Bakelite Company,** a Division of Union Carbide and Carbon Corporation. Cable producers were one of the first to use this new material during World War II when it was a much needed insulation for military field wire, radar equipment and submarine cable.

* * *

In the new era of television, electronic brains, coaxial cables, and transatlantic telephone cables that followed, polyethylene swiftly established a solid reputation as a superior electrical insulating material. The chronic shortage of polyethylene in the early years, however, held back its development for telephone industry use for a time. But, they never lost interest in the new material, since polyethylene proves to be more than just a good dielectric material. It offers an unusual combination of electrical, mechanical and chemical properties.

* * *

One of the outstanding properties of polyethylene is its remarkable resistance to moisture and water vapor. Polyethylene does not lose its effectiveness as electrical insulation once it is exposed to water. This means that service will continue if the jacket of a polyethylene insulated cable is ruptured during a storm. It also means that repairs can be made on a routine rather than an emergency basis.

* * *

This ability to keep on operating in the presence of moisture does away with expensive terminal equipment on exchange area cable distribution. Lead-paper cable usually requires hermetically-sealed terminals to protect it from moisture. Less costly terminals that are weathertight but not moisture-proof can be used with polyethylene insulated cable. These terminals also permit easier access to the cable core for rearranging or adding to wire pair terminations. With an average count of 25 terminals per mile of distribution cable, the possible savings in labor and terminal cost quickly build up to an impressive amount.

* * *

In addition, polyethylene cable is light and easier to handle than lead-sheathed cable. The weight difference has the immediate result of a substantial reduction in freight charges. Since cable insulated with Bakelite polyethylene can weigh less than half as much as lead-paper cable, the necessary equipment for stringing aerial lines can be reduced commensurately in strength, weight and cost. Smaller poles, or even fewer of them are needed. Hangers and messengers can also be made lighter.

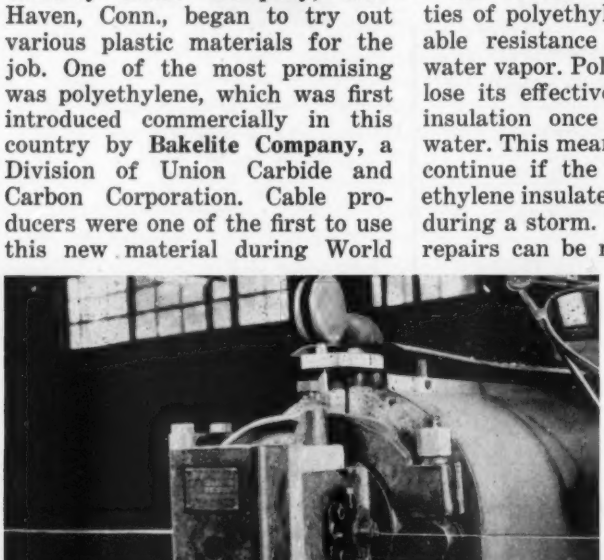

Fig. 1—Extruding polyethylene to form continuous insulation about 1/64" thick around a single conductor. * * * *

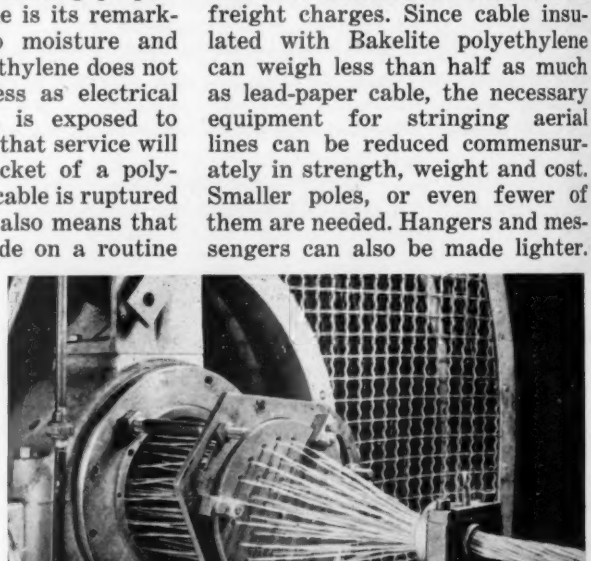

Fig. 2—Pairs of wires are twisted together and fed through die that twists 50 wire pairs together to form cable core. * *

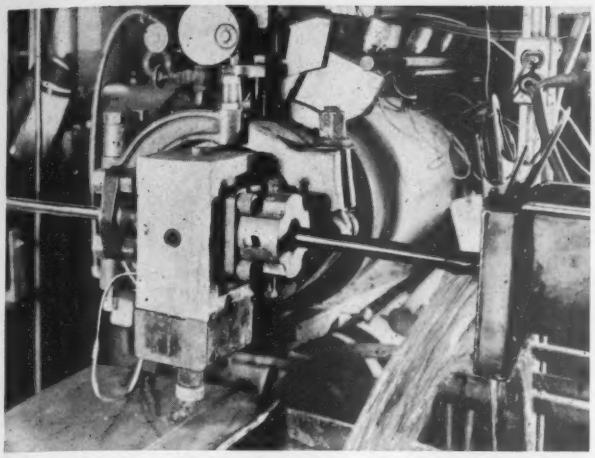

Fig. 3—Polyethylene tape and aluminum shielding being wrapped around core before black polyethylene outer jacket is extruded in place.

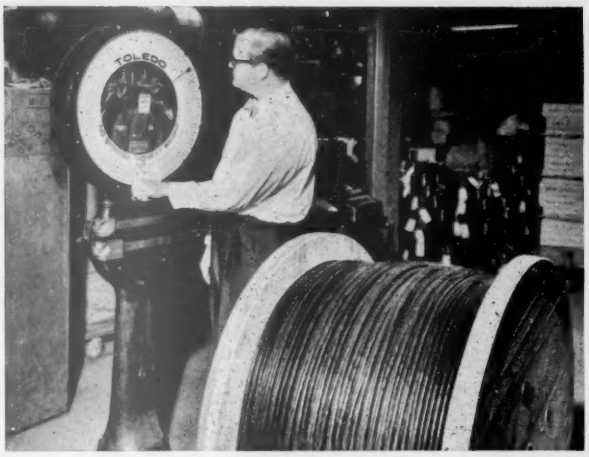

Fig. 4—This type of cable weighs half as much as a paper-lead cable, saving in freight and making for easier handling.

Cable splicing is another area in which polyethylene provides a distinct economic advantage. To splice lead cable requires a highly skilled specialist who comes too high for most small telephone companies to keep on their payrolls. Usually splicers have to be hired for a specific job. With polyethylene cable, however, proper splicing methods can easily be learned by non-skilled workers after a short training period.

* * *

These immediate benefits from reduced freight charges, lower equipment, labor and maintenance costs were highly attractive to the smaller independent telephone companies from the start. This is reflected in a recent survey made of its borrower systems by the Telephone Division of the Rural Electrification Administration. These borrower systems are mostly small independent companies. The survey covered the amount and type of cable purchased by the borrower systems in the past five years. For 1951 the survey shows lead-paper being used exclusively. The following year, when polyethylene insulated cable was introduced commercially, it gained a foothold amounting to less than 5 per cent of the total cable purchased. But within three years its portion had risen to 20 per cent. And in the first nine months of 1955, plastic cable represented nearly half (49 per cent) of the total of 4,895,550 feet of cable purchased in that period.

* * *

Initially polyethylene cable was available with only a limited number of wire pairs. For a while, it was thought that 51 pairs might be the limit. But through improvements in fabrication, Whitney Blake has been able to produce cable with 303 pairs. The new multi-pair sizes appreciably widen the market for polyethylene cable. Recent information received by Whitney Blake indicates that the larger telephone companies are now beginning to follow the trend set by the smaller companies.

* * *

Accelerated aging test methods have been developed which affect polyethylene in manner similar to sunlight. These tests, when extended and supplemented, indicate that suitably prepared polyethylene jacket compounds should perform satisfactorily on aerial cable for upwards of 20 or 25 years. Such polyethylene compositions are not subject to so-called "environmental cracking" when subjected to torsional stress as cable sheath. No other thermoplastic material has given as good assurance of such aerial cable sheath life expectancy as has polyethylene. Bakelite polyethylene is used to insulate the conductors in Whitney Blake's new exchange area Telecable. The wall thickness of this insulation is about one sixty-fourth of an inch. This provides mutual capacitance values, which determine the clarity of the transmitted message, well within the limits to which paper-insulated cables of equal size are manufactured.

* * *

To minimize the possibility of cross talk or noise, Telecable twists the wires in pairs. The length of twist is varied between adjacent pairs in a layer and between adjacent layers. A spiral layer of polyethylene is wrapped around this core of wire pairs to act as a binder and cushion for the metallic shielding tape that goes over it. An outer sheath or jacket of black, weather-resisting polyethylene completes the cable. This tough and flexible jacket withstands sunlight, atmospheric temperatures and stresses to be expected during installation. When tested for ability to bend at low temperatures in accordance with the same specification, no cracks will occur at temperatures as low as —60°C.

* * *

As the price of polyethylene has moved steadily downward, the price of this cable has become comparable with paper-lead cable of the same size. Economies in shipping, labor and maintenance provided by the unusual properties of polyethylene, however, weight the balance more strongly in its favor. Further improvements in manufacture are expected to broaden its application and reinforce the trend it has started in the telephone industry.

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Aluminized Strand Service Test Results

by E. B. Brant
Products Manager
Page Steel & Wire Division
American Chain & Cable Company Inc.
Monessen, Pennsylvania

Back in May of 1953, a regular section of ⅜ inch 1x7 Aluminized High Strength Guy Strand was furnished to one of the country's leading electric utilities for use in a climatically unfavorable service area. The purpose was to submit the strand to severe usage in all types of weather — fog, snow, rain, hail, sleet, corrosive atmospheres, smog, etc. — typical of certain sections of western Pennsylvania and portions of West Virginia.

* * *

The guy strand was erected by the electric utility in July of that year. With the passage of time—more than five years of continuous service—officials of our company and the utility decided to check the installation, note deterioration, if any, and make a report on the condition of the strand.

* * *

Accordingly, a sample of the guy strand was taken from the excess at the pole and returned to our laboratory for closer examination. Illustration 1, shown elsewhere, shows the product at approximately 2 magnifications, both as received and as scrubbed with soap and water. It should be noted that after scrubbing, the bright continuous surface of the aluminum coating is still retained. The dark coloring was due to the formation of an aggregation of sulfide, oxide and soot on the wire's surface during exposure to the high sulfurous atmospheres present in the location during its five years of service.

* * *

This guy strand—as erected more than five years ago by the electric utility—was characterized by the following physical dimensions and coating properties:

Size	⅜ in.
Number of Wires	7
Size of Individual Wires	0.119 in.

The results of these tests, in view of the interest in aluminized wire, are published for the benefit of the industry.

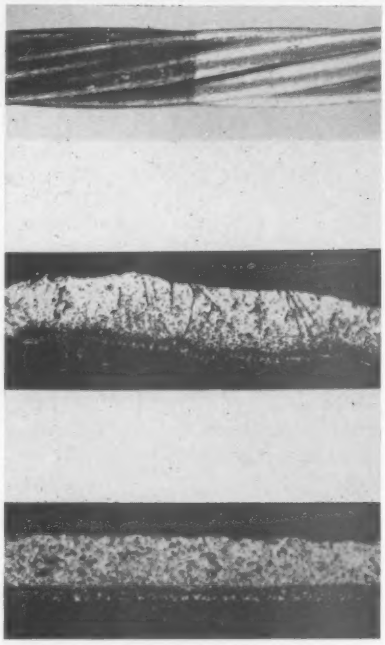


PHOTO #1 . . TOP—This is a segment of the ⅜ inch 1x7 ACCO Guy Strand, magnified twice. To the left is the "as received" condition after more than five years of continuous service in a corrosive atmosphere. That, to the right, is a portion which has been scrubbed clean with soap and water.

PHOTO #2 . . CENTER—This photomicrograph, at approximately 500 magnifications in a bright field, shows the transverse section of the center wire in Page's ACCO Aluminized Guy Strand. An alloy layer thickness of 0.0002 inch and a total aluminum coating thickness of 0.0015 inch was measured.

PHOTO #3 . . BOTTOM—This photomicrograph, at approximately 500 magnifications in a bright field, shows the longitudinal section of the same center wire of the long-tested guy strand. Here, an alloy layer thickness of 0.00025 inch and an aluminum coating thickness of 0.0014 inch was measured.

Breaking Strength of Strand	11,500 to 11,525 lb.
Per Cent Elongation in 24 in.	12.5%
Coating Weight 0.27 oz./ft.² of aluminum	

Laboratory Tests

At the research and development laboratory in Monessen, examinations of the strand sample, secured from the test site, revealed the following:

1. *Physical Properties of Wire:*
Several exhaustive tests showed no loss of the strand's physical properties. Both the center and outside wires were gauged at 0.120 in.; the tensile strength of the center wire was calculated at 152,800 psi. and at 153,000 psi. for the outside wires.

2. *Coating Weight:*
Outside Wires .....0.29 oz./ft.² of al.
Center Wire .....0.27 oz./ft.² of al.

3. *Microscopic Measurements:*
Microscopic measurements of the coating were made at approximately 500 magnifications. Results are shown below, and in photomicrographs 2 and 3, taken at 500X.

Center Wire—Transverse Section:
Alloy layer thickness was 0.0002 in. Total coating of aluminum was 0.0015 in. thick.

Center Wire—Longitudinal Section:
Alloy layer thickness was 0.00025 in. Total coating of aluminum was 0.0014 in. thick.

* * *

Upon evaluation of these tests, the coating weight determinations made on this guy strand indicate a negligible loss of aluminum coating during the five years of continuous exposure under very severe and adverse service conditions. The bright wire weights, after stripping, and the smooth surface of the wire strands also indicate that the product was not attacked. Therefore, results to date are most gratifying to us, as the manufacturer, and to the consumer. It is reasonable to conclude that the erected guy strands will give an exceptionally long period of satisfactory service.

Specifications

For the sake of clarification, our company has successfully combined two time-tested, but dissimilar, metals in the production of wire and wire products. Steel is used for the basic strength. Aluminum, for the coating, is applied by a hot-dip method which is covered by United States and Foreign patents.

* * *

The coating in contact with air has a most important property

(Please turn to page 1155)

Light Nickel Alloy Retort for Wire Anneal Line

by Frank J. Bennett
Engineering Manager
Ansonia Division
The American Brass Company
Ansonia, Connecticut

Departing from the use of conventional furnace materials, a higher degree of flexibility and efficiency was achieved in annealing brass wire at the author's plant in Ansonia.

A new 31-ft., two section heat treating retort of light-weight construction, installed recently in one of the continuous wire annealing furnaces at **American Brass Co.'s** Ansonia, Connecticut, plant is operating with only 10-20°C. interior-exterior temperature differential, can be brought from room temperature to 700°C. in 6 hours, and—according to its designers and fabricators—may add operational flexibility to the line.

* * *

Although the retort has not been in operation long enough to give evidence of its anticipated life, there are several points of interest in the design of the retort and its performance so far.

* * *

The new retort has replaced one nine times its weight and by so markedly reducing the mass to be heated has reduced the exterior-interior temperature differential by 130-150C. average. It can also be brought up to 700C. one and one-half hours faster than the previous 1 3/4-in. thick cast steel retort could be brought to 500C.

* * *

The fabricated retort, approximately 31 ft. 6 in. long, 42-in. wide, and 23½-in high, was made from 3/16-in. thick Incoloy* nickel-chromium alloy sheet by **Rolock, Inc.**, Fairfield, Conn., specialists in the manufacture of high temperature equipment.

* * *

The entire retort is made of the same material and is of the same thickness throughout to eliminate the unequal stress that occurs at points where two metals of unequal mass or composition are rigidly joined and subjected to high temperature service.

* * *

The Incoloy alloy, used in the fabrication of the piece, has been successfully employed in a great many high temperature applications for a number of years. The high percentage of nickel (32%) and chromium (21%) give the alloy the necessary strength, ductility and resistance to oxidation required for such service. It is readily weldable and otherwise fabricated by common methods. Although currently used at 700-750C. at American Brass, the alloy has given long, trouble-free service at temperatures up to 1000C., permitting latitude in the selection of temperatures required for different anneals, metals and production rates.

* * *

The design of the retort is unusual. The arched top and two sides are round-corrugated on 3 in. centers to provide extra strength and also to provide a greater area of exposure to heat. The bottom is box-corrugated for the same reasons, and also to provide an inside surface suitable for the mounting of conveyor chain wear-plates. Box corrugations give the retort required extra strength, because it is not bedded on a solid foundation. Two longitudinal rows of bricks, about two feet apart form a base for the bottom of the retort to rest on, leaving the center and side areas of the retort bottom unsupported. The box construction adds the strength necessary to support the retort itself, the weight of the conveyor chain, and the load being processed.

* * *

The end flanges of the retort are made of mild steel welded to the Incoloy alloy with Inco Weld "A" rod, made specifically for dissimilar metals welding.

Fig. 1—Brass, bronze, and Everdur wire are stacked on a conveyor in preparation for trip through new lightweight annealing retort recently installed at American Brass Company's Ansonia Plant. Retort is special design, has been in use since last January.

The light-weight retort is bricked into place in the American Brass continuous bright-annealing furnace in two sections, joined in the middle. The furnace also is in two sections. The north section, where the coils of wire are loaded on the conveyor by hoist, is heated by three natural gas burners beneath the tube. Temperature read-

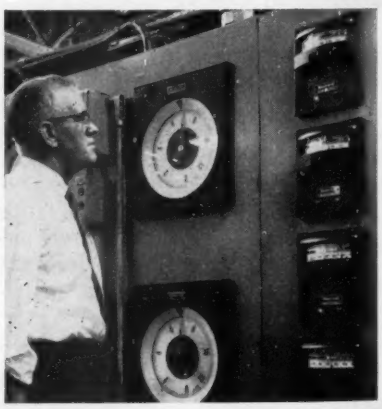
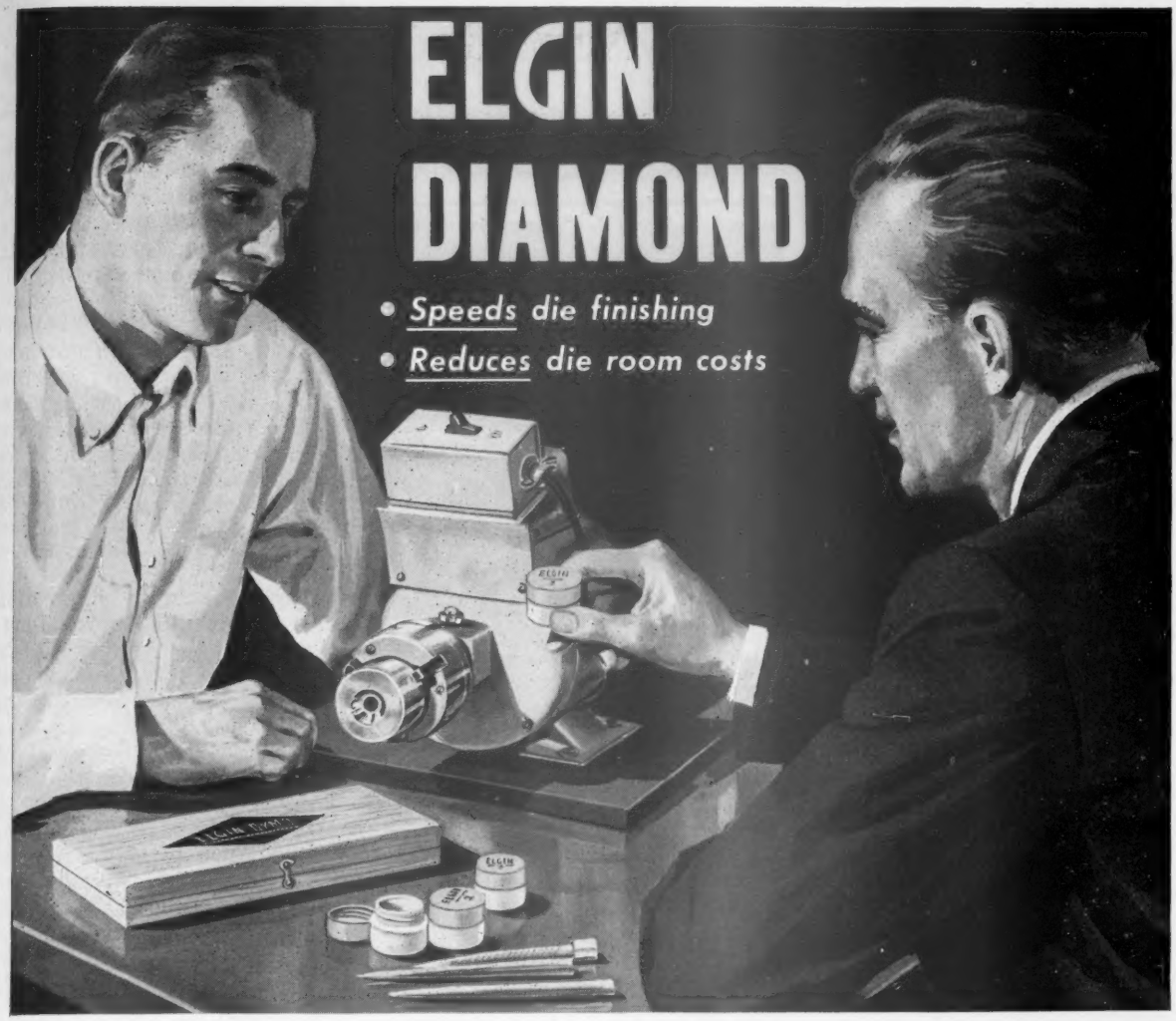


Fig. 2—Thermocouples at two points inside and outside retort show temperature differential of the 3/16-in. thick tube. Furnace gas temperature is 720°C.; inside retort it is 700°C. Cast steel retort controls (two lowers pyrometers) show over 250°C. difference.

(Please turn to page 1156)



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*Dymo-C—for Carbide Dies ‡Dymo-D—for Diamond Dies

Abrasives Division **ELGIN NATIONAL WATCH COMPANY**
ELGIN, ILLINOIS

Sheffield's New Rod Mill

Rod mills have been increasing steadily in speed—and cost. This one is no exception. One feature is the greatly increased size of the billets handled.

The newest and finest rod mill in the steel industry began operation June 15 at the Kansas City plant of **Sheffield Division, Armco Steel Corporation.** The 23-stand, three-strand mill is the fastest 10-inch rod mill in the world. Built at a cost approximately $10-million, the mill is the most expensive single project in the history of the Kansas City works. Planning and construction of the mill took five years.

* * *

The purpose of the new mill is to produce high quality finished rods for reinforcing and wire rope, and to increase production of wire mill and bolt and forged products. Preliminary estimates indicate the new mill will more than triple present rod production at the plant.

* * *

The most modern concepts of rod mill design have been incorporated into the new mill. The mill's production cycle begins with 1,000 to 1,800 pound, 40-foot long, 2¾ to 3⅝ inch square steel billets. These billets are reheated to 2,100 degrees rolling temperature in the billet reheating furnace. From the furnace, billets are pushed into a three-strand switching mechanism and begin their journey through the 23-stand, closed-top housing, Morgoil-bearing-equipped mill. The rod mill is made up of four multi-stand mills: the roughing mill, intermediate mill, looping mill with its three repeaters and six-stand rod finishing train.

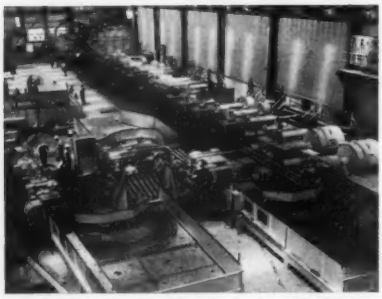

Fig. 2—This 23-stand, three-strand mill is the fastest 10 inch rod mill in the world. Billets leave the billet reheating furnace in the upper left of the picture and travel through the roughing mill, intermediate mill, looping mill with its three repeaters, and into the six-stand rod finishing train. From there they pass through the four-stage high pressure water descaler and are coiled on laying reels. * * * * * *

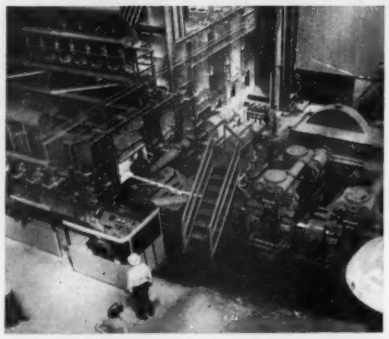

Fig. 1—The first billet is pushed out of the two-zone Rust billet reheating furnace into the roughing mill. Officials believe the mill crew set a record in getting Sheffield's new rod mill into operation. Though the mill won't reach rated capacity for several months, by the third day of operation, the crew had the mill rolling and coiling No. 5 rod in all three strands simultaneously. * * *

From the finishing train, rods pass through a four-stage, high pressure water descaler to insure high quality. Then traveling at speeds up to 6,500 feet a minute, the rods are delivered into reels. The reels coil 1,000 to 1,800 pounds of rod, making Sheffield's Kansas City plant the second steel mill in the country to coil continuous rods of that weight.

* * *

This high speed makes the mill the fastest 10 inch rod mill in the world. Roller twist guides, designed for the mill by **Morgan Construction Co.,** make this high speed possible. Installed for the first time at Kansas City, these guides are set at a 45-degree angle and automatically twist rods after they pass through stands 1, 3 and 5 in the rod finishing train. The roller twist units also hold scratching of rods to a minimum. If the guides meet expectations, rolling speed—which has been the major limitation of high yield rod production—will be greatly increased in mills of the future.

* * *

Other features of the mill include: the latest continous circulating lubrication systems which require five viscosities of oil; a signal control panel which automatically locates points of trouble in the lubrication systems; two hydraulic systems for traverse alignment and top roll balance; double-deck construction which gives the mill a yard level and an elevated deck 14 feet above the ground for the mill; magnetic amplifier speed regulating equipment which will control the speed of the mill's 23 stands to within ¼ of one percent; a narrow gauge railroad which will transport crop ends from beneath the mill to a scrap car, and a Rust two-zone billet reheating furnace—43 x 50 feet—which has a rating of 112 tons an hour.

* * *

Perhaps the most interesting feature of the mill is the way Sheffield engineers have solved a problem of geography. The new rod mill is located on the east side of the Blue River. Spanning the 1,750 foot distance from the new rod mill to the wire mill on the west side of the Blue River is a covered, overhead hook carrier, for delivering coiled rods to the wire mill. The carrier will also deliver coils to an unloading station in the rod mill for shipment to other fabricators. The carrier crosses the river, several railroad tracks and a heavily traveled road.

* * *

One of the major problems of all rod mills—the cobble or runaway rod which occurs when a rod misses a pass through a stand—will be

(Please turn to page 1158)

Fig. 3—These laying reels coil rod at speeds up to 6,500 feet a minute. Each coil weighs 1,000 pounds, making Sheffield's Kansas City plant the second steel mill in the country to coil continuous rod coils of that weight. From the reels, coils are pushed onto the coil conveyor and then upended onto a hook carrier. The carrier transports the coils to the wire mill over several railroad tracks and across the Blue River, a distance of 1,750 feet. * * * * * *

Corrosion-Resistant Steel Screws, Bolts, and Nuts

by Dr. G. Becker
Deutsche Edelstahlwerke A. G.
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Extensive tests on chromium diffusion into surfaces of steel in order to impart corrosion protection to steel products have been going on for some years. This article reports the results of research that has perfected the process for fasteners and other steel products.

The gradual destruction by corrosive attack of parts made of iron and steel has always been a troublesome problem. The usual method of preventing corrosion is to provide some kind of surface protection. In the case of screws, bolts, and nuts, corrosion-resistance is especially desirable because these are fastenings which are expected to be undone and used again.

* * *

It is therefore a fortunate circumstance that the method of chromising is available for imparting to screws, bolts, and nuts of unalloyed steel the properties of a stainless chrome steel. This is simply done by the diffusion of chromium into their surface, the resultant protective effect being superior to any other known surface treatment. The process of diffusion takes place at elevated temperatures in the vapour phase and is performed via the chromium halides. The result is the creation of a chromised surface zone in which the chromium content decreases with increasing depth from about 30% at the face. The chromium atoms migrate into the base material and are incorporated in the crystal lattice of the iron. The surface zone thus created is therefore integral with the base material and consequently it cannot flake off. Fig. 1 is a photograph of a typical diffusion-chromised steel bolt which has undergone a bending test. The bolt has been ground away on one side and, after immersion for a time in boiling nitric acid, reveals that the chromised diffusion zone has taken part in the bending process without showing signs of cracking or flaking. Since different halides produce different results the conditions under which chromising takes place can and should be controlled accordingly.

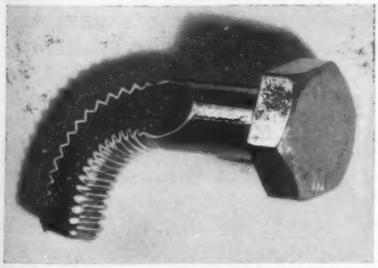

Fig. 1—Diffusion-chromised steel bolt that has been bent after chromising. Note that protected zone has not cracked or flaked off.

* * *

The choice of halides is determined partly by their applicability, their price, and other factors, such as the method of heating and the type of furnace in which the treatment takes place, and partly by the nature of the parts that are to be treated as well as by local working conditions. Although, in principle, any steel can be chromised, experience has shown that the best corrosion resistance, sufficient to satisfy all practical needs and one that will remain effective for a very long time, calls for the use of a steel that is especially amenable to the chromising treatment. Patent protection is held in this particular field by the Deutsche Edelstahlwerke A.G., of Krefeld, Western Germany. This firm provides special steels, described as IK-Steels (from "InKrome" steels), which are intended primarily for the production of parts which are to be chromised by vapour phase diffusion.

* * *

Short tests, especially tests conducted under conditions of exaggerated severity, as are sometimes performed in materials testing laboratories, are apt to give results that are strictly applicable only to the actual conditions selected for performing the test. They may therefore lead to conclusions which are misleading and fail to predict later experience based on long periods of service.

* * *

Diffusion-chromised surfaces have already stood the test of time. In fact, the advantages their use will confer is most strikingly demonstrated in the case of diffusion-chromised steel screws, bolts and nuts, which have been exposed to adverse practical conditions for lengthy periods of time. It is then found that owing to their corrosion resistance such screws and bolts can still be easily undone and that their threads are in a state of such good preservation that they are fit for immediate reuse. This latter circumstance, namely that the threads keep intact, is a matter of some importance, because it actually ensures the dependability of the screwed or bolted connection. Deterioration of the threads by corrosion will naturally weaken the joint and may lead to ultimate failure.

* * *

New methods and techniques are rarely perfected without passing through an initial period of teething troubles. The development of the diffusion chromised steel screw and bolt naturally also passed through this stage, but every difficulty was successfully overcome. In the course of the last few years the chromised steel screw, bolt and nut, has been further perfected and is now improved to such an extent that the highest demands can be satisfied. Physical properties were developed both by improving the suitability of the steel as well as by devising appropriate finishing treatments. Standard diffusion-chromised screws, bolts and nuts, for normal practical applications, have a yield point not under about 20 tons/sq.in. and a tensile strength of at least 33 tons/sq.in.; also their notch toughness is good. In other words, their

properties are fully sufficient for the great majority of practical needs.

* * *

These figures apply both to machine screws as well as to diffusion-chromised wood screws. The risk of shearing off the heads of wood screws under stress is therefore as good as non-existent. However, considerable quantities of diffusion-chromised screws, bolts and nuts, are at present in use which have tensile strengths of about 45 tons/sq.in. and a yield point of about 40 tons/sq.in. and even tensile strengths of something like 50 tons/sq.in. and a yield point around 40 tons/sq. in. When made to this latter specification, especially as regards the very high yield point, diffusion-chromised screws and bolts are physically superior to brass screws and to some extent even to screws of high quality copper alloy.

* * *

Normally, the depth of the chromised surface zone is about 4 thousandths of an inch, depth in this context being understood to be a zone in which chromium content exceeds 13%. However, in the course of normal production thicker zones are also produced.

* * *

Two bolts, one with a chromised surface zone of standard depth and one with a protective zone of greater depth are shown side by side in Fig. 2. The thickness of

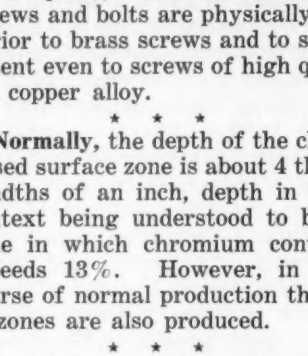

Fig. 2—Diffusion-chromised steel bolt with respectively standard and thickened zones.

the chromised zone can be controlled by varying the duration of the treatment as well as the treating temperature. Necessity and economy are the two factors which govern the choice of depth. It is not usually practicable to go beyond 0.008" and only special applications demand a depth of 0.012" and more.

* * *

Experience with diffusion-chromised steel screws, bolts and nuts, already covers a number of years and results have been most satisfactory. In one particular instance where such bolts were exposed to very adverse and corrosive atmospheric conditions they proved to have withstood the test of time without the slightest adverse effect. Similarly satisfactory results were obtained in a railway tunnel where the constant deposition of soot and the surplur fumes emitted by engines in conjunction with permanent dampness create conditions which greatly favour metal corrosion.

* * *

Moreover, diffusion - chromised steel bolts have been found to be compatible with a variety of other metals. For instance it has been reported that brass parts which had been assembled with diffusion-chromised bolts, and which were inspected at regular intervals, disclosed no interaction between the brass and the bolts even after long weathering. The diffusion-chromised bolt is also becoming increasingly popular in the light metal industries and is recommended for its usefulness in this particular field[1]).

* * *

Apart from the light metal industries the diffusion chromised bolt has been gaining in popularity in light steel engineering. It seems that the structural engineer is again paying greater attention to the bolt as a fastening means[2]) and the corrosion-resistant diffusion-chromised bolt has benefited accordingly. The general tendency being to reduce structural weight it is obvious that mechanical strength, especially tensile strength of the fastening must not be allowed to suffer. A bolt which initially has satisfactory properties is not a reliable element when its design section has been reduced to a minimum and corrosion further reduces its strength. It is therefore a matter of the utmost importance that bolts used in lightweight framing and structures should be particularly resistant to corrosive attack.

* * *

It is also desirable and often a necessity that components should be easily replaceable for effecting repairs. Again such work is greatly facilitated if the bolts have not corroded and can be easily undone and, if necessary or thought desirable, can be reused for reassembling the parts. All these matters illustrate the value of the high corrosion resistance diffusion chromising provides.

* * *

Apart from giving protection against corrosion by moisture, the high chromium content of the surface of a screw or a bolt inhibits scaling under high temperature conditions. Elevated temperatures simply cause the formation of a resistant and adherent oxide skin which then effectively prevents further high temperature deterioration. Naturally there is a critical temperature beyond which this protection will fail. Under continuous high temperature conditions the limit is between 1450 and 1550° Fah. At still higher temperatures the oxide skin increases in thickness and, owing to the gradual migration of the chromium further into the base metal, the chromium content in the surface layer diminishes with a concomitant decrease in resistance to scaling. However, exposure to excessive temperatures for short periods makes little difference and entails no undesirable consequences. The slightly better high temperature properties of the IK base-material over normal steels also contribute to improving the behaviour of diffusion-chromised bolts at temperatures under 1450°F.

* * *

It is occasionally the practice to embed steel screws in light metal castings. Normal steel screws will oxidise at the casting temperatures and special precautions must therefore be taken to ensure that the screws will be firm when the casting cools. Owing to their high surface content of chromium, diffusion-chromised screws will withstand these temperatures so that intimate contact between the screw and the material of the casting, resulting in absolute firmness of

(Please turn to page 1159)

[1] cf. Aluminum Taschenbuch, 11th ed. p. 7. 42.

[2] World Oil, June 1955, p. 39; Steel, July 1955, p. 1; Coal Age, July 1955, p. 145.

Electron Processing Techniques for Wire and Cable Irradiation

by D. A. Trageser
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This paper was presented at the Seventh Annual Symposium on Technical Progress in Communication Wires and Cables at Asbury Park, N. J., on December 4, 1958, under the sponsorship of the U. S. Army Signal Research and Development Laboratories.

The radiation crosslinking of elastomers and of polyethylene has been studied intensively in the last few years. The beneficial properties produced have been reported by a number of investigators. (1-5). There are already some commercial processes based on the irradiation of polyethylene-coated wire and also of tape for the wrapping of coils and cable. Many types of radiation sources have been used experimentally to explore the change of physical properties in polymers. These sources include radioactive isotopes, reactor waste products, reactor radiation itself, and electron accelerators. Only the high-energy beams from electron accelerators have enough compacted radiation power and efficiency of application to be of economic interest for present and future applications in the wire and cable industry.

Uses in Wire and Cable Industry

There are many possible uses in the wire industry for electron-processed plastic materials. The electron processing would provide cold vulcanization of silicon tapes, and controlled placement of cross links in the polyethylene sheaths of insulated telephone or power cables. It would also provide improvement in properties of polyethylene extrusion-coated wire. There have been few detailed results reported on the polymer-coated wire products themselves. One wire manufacturer recently concluded from a series of tests on polyethylene-coated wire, irradiated with a 2-Mev Van de Graaff accelerator, that low-density polyethylene can be converted by radiation into a unique electrical insulation material. The properties of the material do not match the physical properties of linear polyethylene or those of any other polymer. Radiation changes the polymer physicals to greater toughness, yet they retain good elongation. The radiation also increases the heat stability for short-term heat histories, as shown by accelerated aging (7 days at 100°C) and shrink-back tests (6). These tests indicate an application for power cables and for appliance wire, where greater toughness and higher short-term heat application are desired.

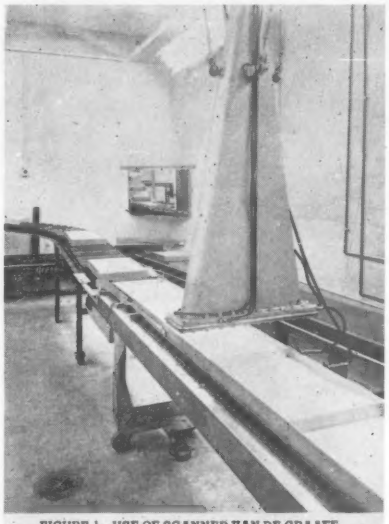


FIGURE 1. USE OF SCANNED VAN DE GRAAFF ELECTRON BEAM ON PROCESSING LINE.

* * *

It is evident that the relatively high cost of radiation will be significantly reduced by:

A. The downward trend in machine costs.

B. The investigation of formulations which lower the radiation dosage requirements (7-10).

C. The engineering of techniques to improve the efficiency of applying electron beams to coated wire products.

Choice of Techniques And Beam Energy

Electrons accelerated to energies of 0.5 to 10 Mev, the useful range for processing consideration, are produced as directed beams and are sharply defined in space. They can be scanned, as the Van de Graaff accelerator beam in Figure 1, for application to material on a processing line. The electrons produce a characteristic and predictable effect in the depth of material treated, as shown in Figure 2.

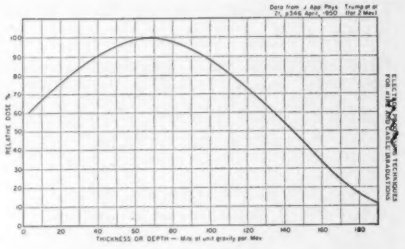


FIGURE 2. DOSE-DEPTH PROFILE

The geometry for best application is calculable. There are many techniques that can be used to apply the beam for highest efficiency of absorption. In the application to wire coatings, the best choice varies with the many wire or cable sizes which might be of interest. In addition to techniques, the other primary variable affecting process efficiency is the beam energy. Fortunately, electron accelerators can produce beams at enough different energies so that an optimum process can be designed for each of many products.

* * *

Circular annuli such as plastic wire insulation, impose unusual consideration of beam geometry. Consideration is necessary to avoid waste of radiation power left after passing through the product, while also avoiding uneconomical over-

irradiation of portions of the product.

Geometry of Penetration for Wire

The extent of a beam's penetration, called the range, is indicated in Figure 2. The range increases directly with the beam energy used, but varies inversely with the specific gravity of the material treated. The practical limit of penetration in plastics, most of which are near to unit specific gravity, is about 1¼ inches when the material is treated from one side. Penetration is about 3 inches for two-sided processing. However, in copper-conductor wires, the insulation on the underside in a single-sided exposure may be unaffected by the beam because the conductor is 8.9 times as dense as the plastic. It, thus, shields the "underinsulation" in all but the smallest wire sizes, unless reasonably high beam energy is used. For example, this restricts the diameter of conductor to less than about 0.012 inches (28AWG) with a 1-Mev beam, or to less than 0.040 inches (18AWG) with 3-Mev. The simple relationship to set the limits among the three factors is as follows:

$$8.9C + 2W = .130E$$

where

C = Conductor Diameter, inches
W = Wall Thickness of Insulation, inches
E = Beam Energy, Mev

* * *

Even if the under side can be penetrated, this method is unduly inefficient because of the waste of beam energy in the copper. Fortuitously, the extremely restrictive density of the copper has necessitated the invention of other processing methods which are more efficient.

* * *

Double-sided treatment is the easiest method of avoiding this problem of penetration and of improving the efficiency at the same time. Although none of the insulation is shielded from the beam by conductor in double treatment, regardless of wire size, the conductor diameter is still an important factor in finding the optimum beam energy to use. However, the type of conductor used has no bearing on the problem whatsoever.

An annulus of insulation presents a varying profile to a unidirectional beam. The path of penetration ranges from a minimum, equal to the nominal wall thickness, to a maximum which can be several times the minimum. It depends on both the nominal wall and the conductor diameter. This relationship is visualized in Figure 3. The mathematical expression for finding the thickest path of insulation, x, in penetration considerations, is also shown.

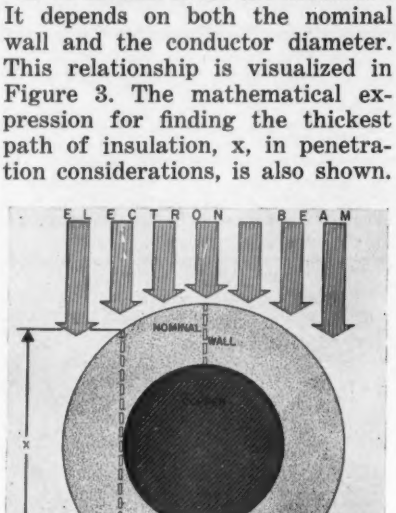


FIGURE 3. PENETRATION PATH IN WIRE INSULATION.

Though Figure 3 shows the geometry for single bombardment, the same equation is applicable for calculating the best beam energy to use with a given wire size in double bombardment, or conversely the best wire size for a given beam energy.

* * *

The relative ionization effect goes through a maximum within the material treated, as shown previously in the dose-depth curve of Figure 2. Therefore, one optimum thickness is used with a given beam energy. This is about two-thirds of the total range of the beam for single-sided bombardment. In double bombardment, the optimum point "shifts", so that the ideal thickness for a given energy is 2.4 times the optimum for single-sided treatment, instead of twice the thickness. Thus, even in a homogeneous material, the efficiency of double bombardment is greater than that of single bombardment.

* * *

In addition, avoiding the conductor-shielding problem in wire geometry by double-sided treatment removes entirely the restriction of the process to extremely small wire sizes or to relatively high beam energies. The range of useful wire sizes and beam energies for double bombardment is shown in Table I. Indeed, wire sizes smaller than No. 6 Gauge processed by this method dictate lower beam energies than those nominally available in the electron accelerators used at present. However, several techniques will be mentioned later which obviate this situation.

* * *

Cables with insulation wall thickness greater than 0.2 inches and conductors larger than Gauge No. 000, such as multi-strand layups, require beam energies greater than 3-Mev with the double-treatment process. One type of accelerator, the microwave linear accelerator, is capable of these higher energies.

* * *

In addition, rotary treatment, an engineering technique, can be

TABLE I. RANGE OF BEAM ENERGIES AND WIRE SIZES FOR DOUBLE BOMBARDMENT

ENERGY	INSULATION WALL	CONDUCTOR SIZES
40 to 75 Kev	0.025 in.	0.026 to 0.096 in. or 22 to 11 gage (AWG)
150 to 300 Kev	0.050	0.050 to 0.190 or 16 to 5
0.75 to 1 Mev	0.100	0.160 to 0.300 or 6 to 1
1.5 to 2 Mev	0.150	0.180 to 0.340 or 5 to 0
3 to 3.5 Mev	0.200	0.320 to 0.440 or 0 to 000

NOTE: Energy is a strong function of both wall thickness and conductor size. Each range covers a group of insulated wires over the ratios of wall thickness to conductor size from about one-to-one to about one-to-three.

used to reduce further the energy requirements for thickly-insulated cables and to improve the efficiency of their treatment. Since the insulation thickness presented to the beam, even in double bombardment, is non-uniform, the beam energy must be large enough to penetrate the longest path encountered, as calculated by the method previously outlined. Rotation of the cable under the beam, however, presents to the beam a constant thickness of insulation which is equal to the nominal wall thickness. Conductor size does not influence the processing geometry of efficiency. About one-eighth-inch of insulation wall can be treated per Mev of beam energy. The loss of radiation power to the conductor is lower than in any other processing method.

Processing Rates

The rate of thruput depends on the dose needed for the properties desired, the efficiency of the method, and the power of the machine. If the beam energy used is optimum for the wire size, according to the various process methods discussed, a one-kilowatt beam can treat the following amounts of insulation at a dose of one Megarad:

Single Bombardment — about 100 lb/hr.
Double Bombardment — about 250 lb/hr.
Rotary Treatment — about 400 lb/hr.

* * *

The linear running speed can be calculated from the unit factor of insulation weight for the particular wire. These rates vary inversely with the dose needed, and directly with the kilowatts of beam power. Accelerators available for processing currently vary from about 2 to 10 kilowatts.

Application of Methods To Continuous Processing

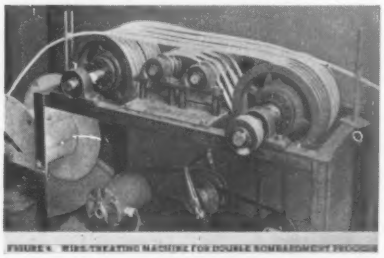
In experimental work, film or wire products can usually be treated on a batch basis by placement on a conveyor line under the beam. Considerations of efficiency are subordinate to the determination of the effect of process variables on the product improvement. In pilot scale-up, relatively large amounts of product can be treated semi-continuously on film winders or wire machines placed inside the shielded room. This room surrounds the machine for protection of operating personnel from the radiations produced when the machine is running. In production, reel-handling facilities can be located outside the shielding. The material then passes through small slits or holes in and out of the shielding wall.

* * *

Since the electron beam has a characteristic definition in area, as well as depth of material, process design involves more factors than the penetration and beam energy. Many wire products are too small to intercept all of the beam's area in one pass. Thus, it is frequent practice to divide the ultimate dosage needed among several passes under the beam. If the product is flexible, it need not be brought outside the shielding for multiple treatment. When double bombardment is used, 180° turning is accomplished at the same time as reversal for re-passage.

* * *

Double bombardment can be achieved either by bending a portion of the electron beam 180°, a technique called beam inversion, for simultaneous treatment on both sides of the product, or by a mechanical means of turning the product. Either method accomplishes the same result with solid products, but the mechanical method is generally easier. A wire-treating machine for accomplishing double bombardment is shown in Figure 4. A number of passes is made under the beam to use the full width of scanning. Between



passes, the wire runs over reels to bring back the opposite side facing up. A unit dosage is delivered during each pair of passes, and is repeated with the next pair. Since alternate passes in each pair are made at different elevations, the reels are staggered so that the top run does not shield the succeeding run. All reels are keyed to the same drive shaft.

* * *

In Figure 4, the wire passes under the beam at right angles to the long scan axis. The number of multiple pairs of passes needed to use the beam's area can be reduced, however, by running the wire parallel to the long scan axis. This technique is essential for other reasons, in the rotary treatment of cable. Here it is necessary to have enough residence time under the beam to allow for 360° rotation of the wire.

* * *

The rotary process is shown in Figure 5, as used with a 2-Mev Van de Graaff accelerator at the British Insulated Callender's Cables Company, Ltd. in London, England. Figure 6 shows the entire facility, including one of the two cable rotation machines. Rotation of the two machines is keyed together to avoid twisting the cable. The rotary techniques is ideal for large cables.

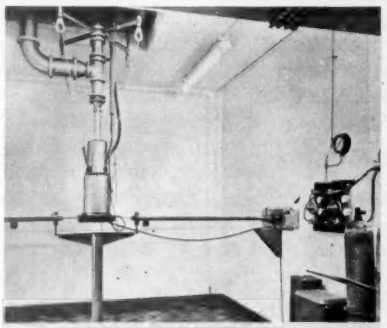


FIGURE 5. ROTARY TREATMENT OF CABLE.
Photograph courtesy of British Insulated Callender's Cables Co., Ltd.

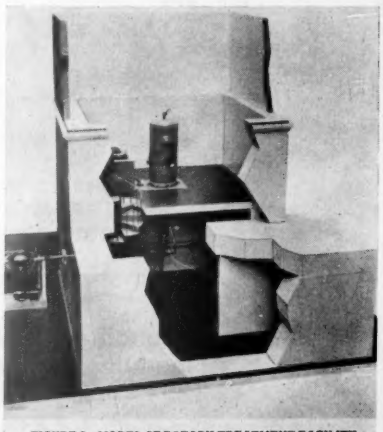


FIGURE 6. MODEL OF ROTARY-TREATMENT FACILITY.
Photography courtesy of British Insulated Callender's Cables Co., Ltd.

One of the objectives of this method is to minimize the beam

energy needed for optimum penetration. On the other hand, with small wires, the objective may be the reverse of this. For example, Table I indicates that insulation walls less than about 0.100-inch require beam energies of less than 1-Mev in a double bombardment process. Even so, a relatively simple technique is available, with which a 1-Mev or higher can nevertheless be used on thin insulation without loss of efficiency. The wire is run at an inclined angle with respect to the verticle beam. This effectively increases the penetration path by a factor dependent on the sine of the angle between the wire and the beam.

* * *

This technique is visualized in Figure 7, where the inclined wire is passed under the electron beam parallel to the long axis of scan, around reels, and back again. Thus, the efficiency advantage of double bombardment over single bombardment is realized. In actual production, several more pairs of runs would be used in order to cover the full "width" of the beam across the wires. Careful arrangement in units of four runs might be necessary, because the beam power may not be distributed uniformly transverse to the direction of wire travel. The vacuum-chamber extension on the accelerator eliminates variable air path between the end of the accelerator and the wire. Consequently, beam scattering is minimized.

Conclusion

A wide range of wire and cable sizes can be processed continuously

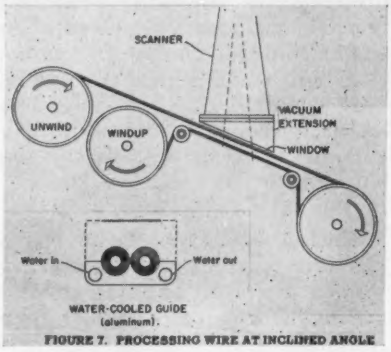


FIGURE 7. PROCESSING WIRE AT INCLINED ANGLE

with various engineering techniques. The choice of technique depends on the wire geometry and beam energy. These two factors also significantly affect the process efficiency, and hence the production rate and cost.

* * *

Single-sided treatment is restricted to very small wires, and the efficiency is very low. Double bombardment, however, can be used on a wide variety of wire sizes. It improves the efficiency markedly. Rotary treatment increased the efficiency further, and is most suitable for large cables. Inclined-angle processing with a low beam energy in double bombardment is the most efficient way for thin insulation.

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ACKNOWLEDGMENT

The author wishes to acknowledge R. M. Emanuelson for the development of many ideas contained in this paper.

A Special Invitation to Our Readers

You who are not now members of the Wire Association, but who are engaged in the production of rods, wire, wire products and electric wire and cable, are extended a cordial invitation to become a member of the Association and join with others in promoting and furthering the interests of our industry.

A booklet describing the functions of the Association and a membership application card will be sent you upon request.

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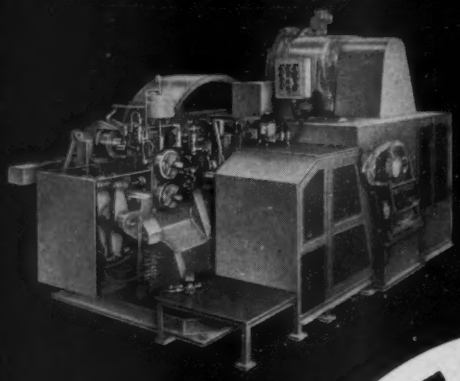

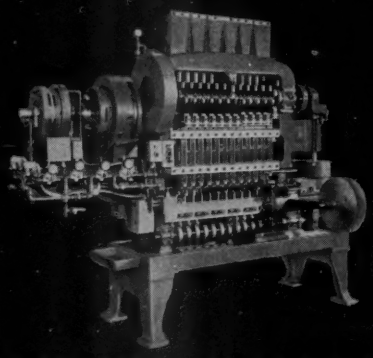

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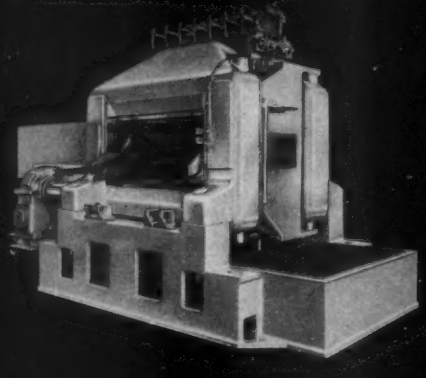

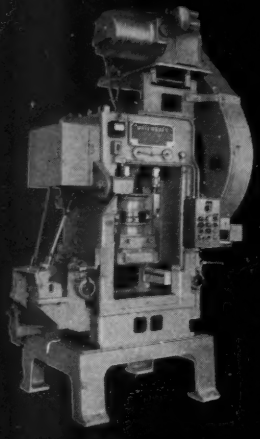

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WF 53

Wire Kinks

Copper-Coated Cold Heading Wire

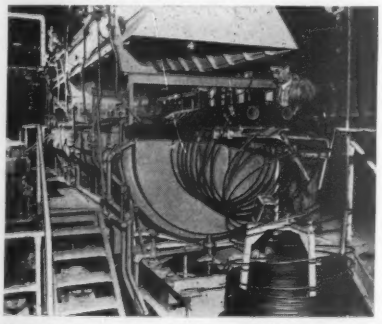
A copper-coated stainless steel cold-heading wire, said to make parts that are superior in strength and grain structure, is now being produced in **Republic Steel's** Massilon, Ohio, plant.

* * *

The wire is wrapped in a protective coating of copper 0.0002-inches thick by an electrolytic copper plating machine—the first of its type installed in the cold-heading industry. This coating serves as a lubricant in the cold-heading operation.

* * *

The new system of plating replaces the method by which stainless steel coils for cold-heading were oxide coated and then drawn through a stearate compound. Poor adherence, lack of uniformity in coating thickness, bare spots and flaking, suggested the need for a better and more uniform coating to aid in cold-heading.



Electrolytic copper-plating machine at Republic Steel's Massillon, Ohio, plant is the first of its type installed for copper plating stainless cold-heading wire. Unit deposits a 0.0002-inch thick coating of copper on stainless steel wire. * * * * *

Cold-heading with copper-coated stainless steel wire produces a better part than one made by machining or grinding from a bar with a diameter equal to the largest diameter of the part.

* * *

The procedure for making copper-plated cold-heading wire starts with the hot rolled rods. The rods are annealed, pickled and then cold drawn within a few thousandths of the finished diameter of the wire. The wire is then annealed again, and pickled free from scale prior to the plating operation.

Readers are invited to send us how-to-do-it items for this department. For each item received that is published we will pay contributors $10.00. Your co-operation will be appreciated by us and our many readers. May we hear from you?

* * *

In the actual copper plating operation the wire, ranging in size from .092 to .625 inches diameter, is fed through the plating machine in a single, continuous strand, preformed to a diameter of 36-inches, which passes through the plating machine as a helix, as shown in the illustration.

* * *

The coils are first given a preliminary cleaning in a degreasing bath, followed by a cold water rinse, which prevents contamination of carryover from the degreasing solution into other compartments of the plating tank.

* * *

The strands then pass through a sulfuric cleaning tank, a second water rinse, and then through a hydrochloric dip compartment, which serves as the final cleaning step.

* * *

After another water rinse the steel passes into a nickel plating solution which deposits a nickel flash on the surface of the stainless wire. This aids in producing a good bond between the copper and stainless steel. The strands then pass through another water rinse and a caustic solution to neutralize any acid which may remain from the nickel flash.

* * *

The wire then passes into the copper plating solution, the speed being regulated so that the wire will be in the copper solution long enough to build up a copper coat 0.0002-inches thick.

* * *

The final steps involve a cold and hot water rinse. The hot water evaporates quickly, drying the coils. Following the plating operation the coils are drawn through a stearate compound to finish size.

* * *

Republic's engineers indicate that the copper-coated wire is used mainly for the production of bolts, nuts, screws and other fasteners. They report that after such fasteners have been produced, they are usually dipped in nitric acid to remove the copper coating.

Self-Locking Wire Thread Inserts Protect Threads In High Pressure Pump

A reusable, self-locking, wire thread insert has reduced original assembly and operating maintenance costs of a semi-portable high pressure paint pump. Made of stainless steel wire, the inserts armor 16 tapped holes in aluminum at critical assembly points on a pump manufactured by the Nordson Corporation, Amherst, Ohio. The insert protects the tapped holes against wear and corrosion while an internal locking feature of the insert has eliminated the need for supplementary locking parts simplifying the pump design.

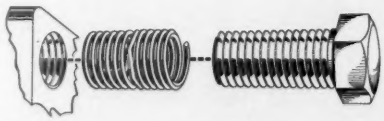


Figure 1 * * * * * * * *

A basic component of an Airless Spray Coating system which sprays paints without using air, this unusual pump operates from vacuum to 1000 p.s.i. 60 times per minute. To assemble the pressure caps in place on each pump as

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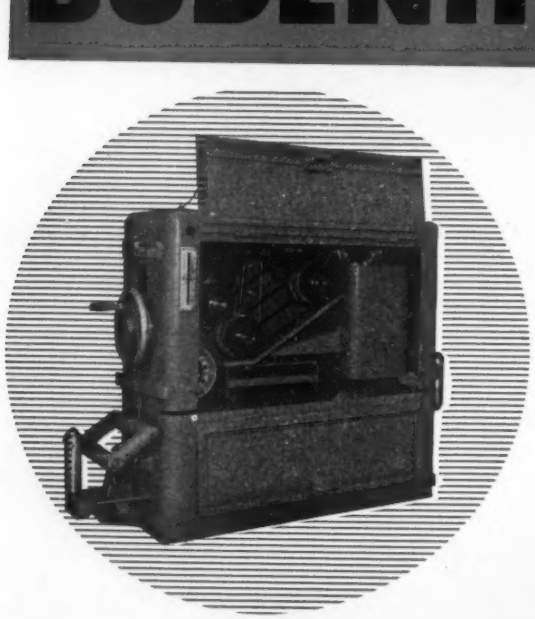

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Wire Kinks

shown in Figure 1, 5/16-18 high strength heat treated socket head cap screws are used. To keep flange requirements to a minimum, cap screws are employed in tapped blind holes where the pressure caps join the pump. In operation these bolts are exposed to extreme vibration and temperature. To reduce weight, simplify design, prevent boss thread stripping and wear and eliminate a need for supplementary lock wiring or lock washers, Nordson incorporated the advantages of Heli-Coil® Screw-Lock Inserts, made by the Heli-Coil Corporation, Danbury, Conn., into the threaded connections.

* * *

Under vibration, all connections in the compressor unit are held securely against loosening by a "grip coil" near the center of the Screw-Lock Insert. This locking coil approximates a polygon in shape instead of being circular as are the other coils of the insert. As a bolt is run through the insert, the grip coil is forced to conform to the thread circle. The chords of the grip coil maintain a strong spring-like pressure on the bolt, giving a locking effect which is not impaired through repeated assembly and disassembly. The bolt may be readily removed by applying break-away torque approximately the same as assembly torque.

* * *

The Screw-Lock Inserts are made from 18-8 (AMS 7245) stainless steel wire having an ultimate tensile strength of about 200,000 p.s.i. and conform with all applicable military specifications. To facilitate identification, all Screw-Lock Inserts are colored red to distinguish them from regular Heli-Coil inserts that do not provide the locking feature.

Wire Stitcher Replaces Several Assembly Operations

A stitching machine that can be used for a number of operations has recently been announced.

* * *

Using a 10-pound coil of wire of desired specifications this novel machine can form and apply retainer rings on the shafts of potentiometers, switches, controls or motors; clamp resistor terminals with flat wire; lock sleeving on a motor brush; provide mechanical fastenings for electrical connections, jumpers between circuits, mount components on panels for assembly; and perform miscellaneous other jobs of like nature.

* * *

The coil of wire used for supply, for example, will make 20,000 retainer rings without reloading, eliminating separate forming and press operations.

—Courtesy of Ideal Stitcher Co., 2323 N. Knox St., Chicago 39.

Bolts Take Greatest Stress During Wrenching

If a bolt doesn't fail when being wrenched up tight, it won't fail in service (assuming bolts and joint have been designed adequately for the loads).

* * *

That's because two forces put stress on bolts (and cap screws) as they tighten: Tension due to bolt stretch; torsion due to friction. But only tension remains after wrenching. In a rigid joint, if this tension exceeds external forces, bolts will never experience any further strain, and will therefore not loosen or fail.

* * *

Obviously, unusual unforseen loads cause trouble. The instant they exceed residual tension, they add to the stress placed on the bolt and can cause immediate failure. Or they can cause loosening, leading to stress change, which in turn causes fatigue and failure. That's why you've got to torque bolts tight . . . and the tighter the better.

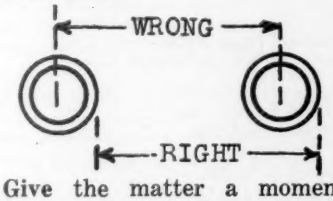
* * *

An exception: A flexible joint. With high cyclic loading, again loosening and fatigue cause trouble. Since you shouldn't tighten such a joint too much, sometimes the only remedy is to take out the flexible element and put in a rigid joint. (A metal to metal flange connection instead of a gasketed one, for example.)

—Courtesy of Russell, Burdsall & Ward Bolt and Nut Co.

To Measure Accurately and Quickly From Center To Center

Time and again it has been observed that mechanics measure center-to-center in the WRONG way, as indicated in the accompanying sketch. If the distance is 8 inches, center-to-center of two pipes, for example, the exact center of each pipe will be laboriously located, and then the distance center-to-center will be measured in the manner as shown WRONG in the sketch.



Give the matter a moment's thought and you will see that the RIGHT way is to measure from side to side as indicated by the word RIGHT. The distance is precisely the same as the center-to-center distance, and it is much more easily and accurately measured.

(Please turn to page 1160)

THE ELECTRIC WIRE & CABLE SECTION OF

THE WIRE ASSOCIATION

This section, devoted to the interests of production men and engineers concerned with production problems, will be responsible for the program of technical papers presented at the Annual Convention of the Association, to be held in Cleveland, Ohio, at the Statler-Hilton Hotel, October 12-15, 1959. Members work closely with the Program Committee in securing and clearing papers submitted for presentation.

All electric wire and cable men are cordially invited to attend the Convention. If you do not belong to the Association, write for a hotel reservation card. It will be sent promptly.

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Technical papers are preprinted in the October issue of Wire and Wire Products insofar as possible. Titles to papers accepted will be given to The Wire Association and duly copyrighted at the time of publication. All papers presented at the Convention by members of The Wire Association are eligible for consideration for the Annual Medal Award and other awards made each year for outstanding excellence.

All wire mill men and wire mill suppliers are invited to attend this convention, see how the Association functions and participate in the activities. Simultaneous technical sessions for Ferrous, Non-Ferrous and Electric Wire & Cable Divisions are held.

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MONDAY, OCTOBER 12th

9:00 A.M.
REGISTRATION

10:00 A.M.
DIRECTORS' MEETING

12:30 P.M.
PROGRAM COMMITTEE LUNCHEON

THE WIRE ASSOCIATION

CONVENTION PROGRAM

MONDAY, OCTOBER 12

9:00 A.M. Registration Desk opens
10:00 A.M. Meeting of the Board of Directors of The Wire Association
12:30 P.M. Directors' Luncheon for Program Participants. Address of Welcome by President Allan B. Dove

JOINT FERROUS AND NON-FERROUS TECHNICAL SESSION

MODERATOR

Allan B. Dove, Development Metallurgist, Steel Company of Canada Ltd.

2:00 P.M. Address of Welcome by Allan B. Dove, President of The Wire Association.

PRESENTATION OF AWARDS FOR 1958 PAPERS

MEDAL AWARD (FERROUS DIVISION): To DONALD K. WHITE, Foreman, Annealing, John A. Roebling's Sons Corp., for his paper "Continuous Patenting, Cleaning and Coating of Steel Rods."

MEDAL AWARD (NON-FERROUS DIVISION): To HAROLD W. ADAMS, Director, Electric Conductor Products, Reynolds Metals Co., for his paper "Fabrication and Properties of 5005 Aluminum Alloy Cables for Overhead Power Lines."

CERTIFICATE OF HONORABLE MENTION (FERROUS DIVISION): To Dr. Ing. HANS KRAUTMACHER, Chief of Experimental Station, Westfaelische Union Aktiengesellschaft fur Eisen, Hamm, Germany, for his paper: "Recent Experiences in Shot Blasting Practice."

CERTIFICATE OF HONORABLE MENTION (NON-FERROUS DIVISION): To J. F. STOLTZ, Engineer, Ironwork & Clearing Products, Rod & Wire Mill, Western Electric Co., for his paper, "Drawing and Insulating Wire in One Tandem Operation."

PRESENTATION OF THE TWENTY-FIVE YEAR CERTIFICATES

THE MORDICA MEMORIAL LECTURE

"The Manufacture of Precision Cold Drawn Shaped Wire" by John Rigby, Managing Director, John Rigby & Sons Ltd., Low Moor, Bradford, England.

PAPER: "Manufacture of Wire Products — Oven-racks, Baskets, and Refrigerator Shelves," by F. B. Thacker, Bauer Bros. Co., Springfield, Ohio.

PAPER: "The Impact of Modernization in Wire Weaving," by T. L. Stilwell, Warner-Swasey Co., Cleveland, Ohio.

MOTION PICTURE: "Building of The Mackinac Bridge" —Courtesy of the American Steel & Wire Div. of the United States Steel Corp.

TUESDAY, OCTOBER 13 — 9:00 A.M.

FERROUS DIVISION TECHNICAL SESSION

MODERATOR

Stewart S. Gray, Asst. Vice Pres., Union Wire Rope Corp., Kansas City, Mo.

PAPER: "A New Method for Fatigue Tests on Steel Wires and Wire Ropes and the Viewpoints Opened by the Results Obtained" — by Denis van de Moortel, Technical Chief Manager, United Rope Works, Leiden, Holland.

PAPER: "Air Force Tow Members" — by Jack E. Tiede, Supervisory Eng., Air Force Proving Center, Elgin Air Force Base, Florida.

PAPER: "High Temperature Tests of Aircraft Control Cable" — by Howard J. Godfrey, Asst. Chief Devel. Eng., John A. Roebling's Sons Corp., Trenton, N. J.

PAPER: "The Rolling of Round Wire into Flats and Rectangles" — by Alexander F. Sperduti, Asst. Chief Eng., The Fenn Manufacturing Co., Newington, Conn.

THE WIRE ASSOCIATION

CONVENTION PROGRAM

TUESDAY, OCTOBER 13 — 2:00 P.M.

FERROUS DIVISION PROGRAM (Continued)

MODERATOR

Rudolf H. Hertzog, Met. Eng., Wire Mills Div., John A. Roebling's Sons Corp., Trenton, N. J.

PAPER: "ABC of Better Lubrication and Cooling in Steel Wire Drawing" — by J. G. Wistreich, Head, Mechanical Working Div., British Iron & Steel Research Assn., Sheffield, England.

PAPER: "Long Production Run Wire Coils" — by Uno V. Johnson, Supt., Rod and Wire Div., Detroit Steel Corp., Portsmouth, Ohio.

PAPER: "Use of Wire in the Cold and Hot Forging Industries" — by Dale Walcutt, The National Machinery Co., Tiffin, Ohio.

PAPER: "Straightline Non-Slip Wire Drawing with Electrical Equipment Using Alternating Current" — by Robert H. Geiss, Manager, Herborn Machinery Corp., Hackensack, N. J.

WEDNESDAY, OCTOBER 14 — 9:00 A.M.

MODERATOR

Carleton W. Garrett, Met. Eng., Graham Research Labs., Jones & Laughlin Steel Corp., Pittsburgh, Pa.

PAPER: "The Manufacture and Properties of Basic Oxygen Steel for Wire Products" — by H. B. Emerick, Dir. of Technical Services, and Sol Kreisberg, Metallurgical Supvr., Jones & Laughlin Steel Corp., Pittsburgh, Pa.

PAPER: "High Speed Rod Rolling" — by E. L. Chamberlin, Div. Supt., American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio.

PAPER: "Quality Control in an Alloy Steel Bar Mill" — by T. P. Davis, Statistical Quality Control Eng., Allegheny Ludlum Steel Corp., Watervliet, N. Y.

PAPER: "Work Sampling in a Nail Mill" — by J. T. Weir, Statistical Eng., American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio.

NON-FERROUS DIVISION TECHNICAL SESSION

BARE WIRE SECTION

TUESDAY, OCTOBER 13 — 9:00 A.M.

MODERATOR

David M. Schmid, Pres., Techalloy Company, Inc., Rahns, Pa.

PAPER: "Trends, Copper and Copper Alloy Rod and Wire" — by Richard J. Christine, Metallurgical Mgr., Torrington Div., The American Brass Co., Torrington, Conn.

PAPER: "A Substitute for Silicon Bronze—Its Fabrication and Properties" — by Roger Martin, Chief Met., Triangle Conduit & Cable Co., New Brunswick, N. J.

PAPER: "Recent Developments in Aluminum Alloy Wire" — by Charles L. Kessler, Chief Works Met., Aluminum Company of America, Massena, N. Y.

TUESDAY, OCTOBER 13 — 2:00 P.M.

MODERATOR

Henry McConnell, Wire Plant Mgr., Sylvania Electric Products, Inc., Warren, Pa.

PAPER: "Some Metallurgical Factors in the Manufacture of Fine Wire" — by C. M. Jackson, J. G. Dunleavy & A. M. Hall, Alloy Development Div., Battelle Memorial Institute, Columbus, Ohio.

PAPER: "Titanium Zirconium Wire Drawing" — by Robert Knight, Sales Mgr., Johnston & Funk Metallurgical Co., Wooster, Ohio.

PAPER: "New Testing Concepts, Strain in Wires in the Elastic and Plastic Ranges by Color Technique" — by Dr. Felix Zandman, Tatnall Measuring Systems, Inc., Phoenixville, Pa.

THE WIRE ASSOCIATION

CONVENTION PROGRAM

WEDNESDAY, OCTOBER 14 — 9:00 A.M.

NON-FERROUS BARE WIRE PROGRAM (Continued)

MODERATOR

Bruce W. Gonser, Technical Director, Battelle Memorial Institute, Columbus, Ohio

PAPER: "Glass Sealing Wires" by E. G. Slick, Div. Metallurgist, Sylvania Electric Products, Inc., Warren, Pa.

PAPER: "Some Age Hardenable Copper-Base Alloys for Wire Products" — by Donald E. Pardon, Design & Devel. Eng., Chase Brass & Copper Co., Waterbury, Conn.

PAPER: "Copper's Future" by R. P. Koenig, President, Cerro de Pasco Corp., New York, N. Y.

PAPER: "Vacuum Annealing of Wire" — by Messrs. Fritz & Michael, Ofenbau Fritz G.m.b.H., Hagen, Germany.

PAPER: "Engineering Wire Tensions" — by Erwin J. Saxl, Pres., Tensitron, Inc. Harvard, Mass.

NON-FERROUS DIVISION TECHNICAL SESSION
ELECTRIC WIRE & CABLE SECTION

TUESDAY, OCTOBER 13 — 9:00 A.M.

MODERATOR

James E. Flood, Technical Director, Plastic Wire & Cable Corp., Jewett City, Conn.

PAPER: "Facilities for Wire Irradiation with an Electron Beam Generator" — by R. P. Skundberg, X-Ray Dept., General Electric Co., Milwaukee, Wisc.

PAPER: "The Use of Irradiated Polyethylene in Wire and Cable" — by A. N. Towne, Specialist-Market Devel., Insulating Materials Dept., General Electric Co., Schenectady, N. Y.

PAPER: "Chemically Cross-Linked Polyethylene" — by Michael M. Suba, Product Sales Mgr., Union Carbide Plastics Co., New York, N. Y.

TUESDAY, OCTOBER 13 — 2:00 P.M.

MODERATOR

Urbain J. H. Malo, Technical Director, Narragansett Wire Co., Pawtucket, R. I.

PAPER: "Thin Metal Strips for Sheathing Telephone Communication Wire" — by H. N. Padowicz, Senior Staff Engineer, Cable Development, Western Electric Co., Kearny, N. J.

PAPER: "Bonding Characteristics of Insulating Varnishes and Wire Enameling Systems" — by Donald L. McClenahan, Chief Elec. Eng., Schenectady Varnish Co., Schenectady, N. Y.

PAPER: "Catalyst Applications for Continuous Strip Ovens" — by Richard J. Ruff, President, Catalytic Combustion Corp., Detroit, Mich.

WEDNESDAY, OCTOBER 14 — 9:00 A.M.

MODERATOR

Philip H. Snyder, Plant Mgr., Electric Auto-Lite Co., Hazleton, Pa.

PAPER: "Production and Laboratory Control of High Quality PVC Compounds for Wire and Cable Insulations and Jackets" — by Q. R. Ball, Asst. Supt., Cable Engineering Labs., Wire & Cable Div., Northern Electric Co. Ltd., Lachine, Que., Canada.

PAPER: "Small Diameter Power and Control Cables" — by Maurice Gilbert, Senior Electrical Eng., E. I. du Pont de Nemours & Co., Wilmington, Del.

PAPER: "An Improved Aging Method of Vinyl Insulation Compounds in a Modified Testing Oven" — by Allen E. Polson, Apex Tire & Rubber Co., Pawtucket, R. I.

THE WIRE ASSOCIATION

CONVENTION PROGRAM

OTHER CONVENTION ACTIVITIES

WEDNESDAY, OCTOBER 14 — 4:00 P.M.

The Annual Business Meeting of The Wire Association. This is a meeting for Association members. Your personal attendance is desired for the transaction of business.

At this meeting members will have an opportunity to learn of plans for the coming year, to offer suggestions for the improvement of services, and to participate in the affairs of the Association.

WEDNESDAY, OCTOBER 14 — 6:30 to 7:30 P.M. — HOSPITALITY HOUR

7:30 P.M. — THE ANNUAL BANQUET

Following the dinner, the group will be addressed by an eminent scientist, DR. JASON J. NASSAU, one of America's foremost astronomers, professor and head of the Department of Astronomy, Case Institute of Technology, Cleveland. Dr. Nassau will discuss astronomy and its relation to the missile program and space travel.

THURSDAY, OCTOBER 15 — 9:00 A.M.

PLANT INSPECTION TOUR

Busses will leave the Statler-Hilton Hotel to visit the Cuyahoga Works of the American Steel & Wire Division of United States Steel Corporation.

All persons taking the tour must go by bus — no private cars may be used.

PLEASE WEAR YOUR BADGES AND HAVE YOUR BUS TICKET WITH YOU.

This Program is subject to further revisions and the final Program will be published in the October issue of WIRE AND WIRE PRODUCTS.

Insofar as possible, all papers will be preprinted in the October issue of Wire and Wire Products. Others will be printed in November and December.

The Convention proceedings, the Story of the Convention and the Mordica Memorial Lecture will be published in the January, 1960, issue.

The New Escambia Research Center

The Escambia Chemical Corporation, manufacturers of chemicals and PVC resins, moved its research operations to Wilton, Connecticut, about a year ago, where it now has one of the finest and most complete laboratories for research and development work in its field.

* * *

Established in 1954, Escambia has made remarkable strides in the manufacture of polyvinyl chloride resins and has at its plant in Milton, Florida—just east of Pensacola—facilities for the production of 50 million pounds of these resins per annum.

* * *

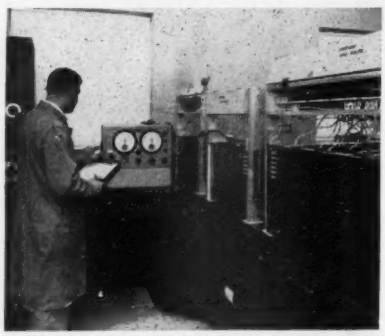
Four of the company's basic resins already have been given Underwriters' Laboratories approval. Some unusual properties have been developed in these resins. One development is a physical form in which the resin emerges from its processing completely free from powder, in fine sized "pearls." This dust-free form is a practical advantage in mill handling and plant cleanliness.

* * *

The laboratory is equipped with small pilot plants for development work and larger pilot plant units that simulate actual production on a manufacturing scale, not alone of the plastic materials themselves, but in blending, dicing and extrusion of finished products—coated electric wire, tubing and injection molded products. Production extruders are employed in this phase of the work.

The Research Center was shown to the press on June 9, at which time the company's guests were guided about the facilities by members of the technical staff. The Center presently has 55,000 square feet of floor space, with provision for further expansion.

Aerial view of Escambia Research Center at Wilton, Conn. * * * * *



Electrical grade PVC is given intensive tests for insulation resistance on equipment shown above. Wires covered with PVC materials are immersed in water for long periods of time in the tank at the right. * * *

* * *

New vinyl resins are continually being made; some of these are homopolymers which satisfy applications where only copolymers could be used before. Some are copolymers to widen the company's polymer line and improve its competitive position.

* * *

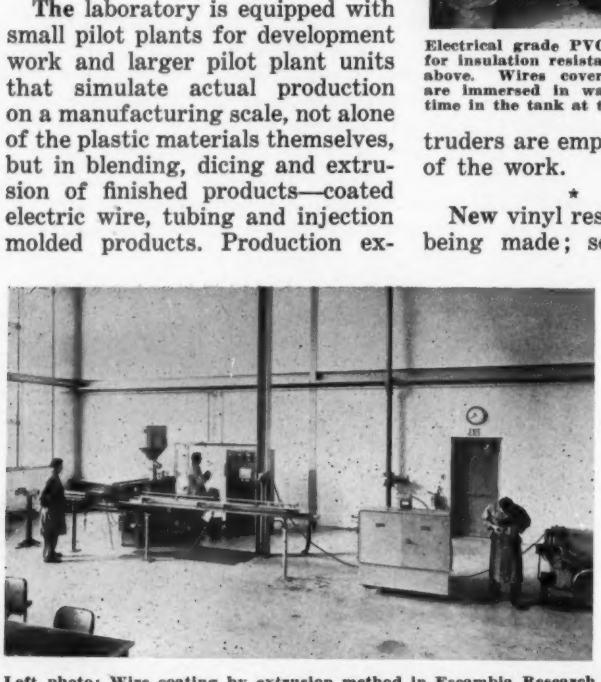
The pilot plant is equipped to develop on a manufacturing scale any formulation which the laboratory indicates to be valuable. These include suspensions, plastisols, latices, copolymers, and new cold dry blending resins to be introduced in the next few months.

* * *

The technical service department is adequately staffed with personnel well qualified by education and experience for the handling of customer service projects. All equipment and the processing techniques associated with its use are constantly being improved. The department also maintains exceptionally well-equipped laboratories for the complete evaluation of polymers and fabricated polymer products, that provide data to customers to insure the most economical sizing of some of the manufacturing components.

* * *

A unique shipping arrangement in piggy-back trailer vans enables the company to ship from the Florida plant by rail, water or truck—or a combination of these —to reach different parts of the country at minimum transportation costs.



Left photo: Wire coating by extrusion method in Escambia Research Center. Right photo: General view of Escambia technical service laboratory showing wire coating by extrusion (rear) calendering (right) and injection molding equipment (left). This is one of the most completely equipped technical service laboratories in the plastics field and is able to duplicate almost every type of operation using plastics material.

Effects of Plasticizers Upon Dry Blending Polyvinyl Chloride Resins

by Russell A. Park
Firestone Plastics Company
Division of
The Firestone Tire and Rubber Company
Pottstown, Pennsylvania

This paper was presented at the Seventh Annual Symposium on Technical Progress in Communication Wires and Cables in Asbury Park, N. J., on December 3, 1958, which was sponsored by the U. S. Army Signal Research and Development Laboratory.

The term "Dry Blending" resin has different meanings to the various resin users in the polyvinyl chloride field. In some instances, "dry blend" refers to a visual appearance of a resin-plasticizer-filler, etc. mixture to which heat has been added. After the addition of heat, the resin appears "dry" or has flowability when compared to the mixture before the heat is applied.

* * *

Another use of the term "dry blend" refers to very highly plasticized resin-filler mixtures which while they do not retain flowability, they remain sufficiently fluffy to be dumped in mass. This type of mixture, in most cases, is blended without the aid of heat.

* * *

Before describing the application requirements for these two types of resin, I would like to describe something they have in common—namely, their plasticizer absorption mechanism.

* * *

The most generally accepted view today is that the plasticizer is first adsorbed on the surface of the resin particle. By definition adsorption is concerned with contracting a solid with a fluid under such conditions that some of the fluid is adsorbed on the surface of the solid. "Two of the most important characteristics of the solid adsorbent (in this case resin) are its extremely large surface-to-volume ratio, thereby presenting a large area on which the fluid may be adsorbed, and its preferential affinity for certain fluid components." (In this case plasticizer)[1]

* * *

When heat is applied to the resin particle with its adsorbed surface layer of plasticizer, the layer is absorbed, that is, incorporated or assimilated into the resin particle. Because of the solvating action by the plasticizer on the surface of the resin particle, it is necessary that the plasticizer wet all the resin surfaces rapidly and uniformly.

* * *

The "dry blend" extruder operator requires a resin that will be free flowing. This will enable the blend to feed the screw via the hopper without interruption. During blending, the resin will be called dry if it allows a hot plasticized blend to fall freely from the blender's paddles or blades. Resins of this type are characterized by high bulk densities and large uniform particle size. Because of this, they have smaller unit surface areas and are less adsorptive than the calender operator's "dry" resin.

* * *

In order to work with highly plasticized, cold blended formulations, the calender operator requires a highly adsorptive resin. This resin, because of its large surface area, retains much less plasticizer on a "unit surface". The operator sacrifices flowability for high plasticizer loadings. Actually, he does not need the flowability required by the extruder operator as the calender operator usually transfers his blend from a mixer directly into a banbury mixer. These resins are characterized by low bulk densities and small particle sizes.

* * *

It should be re-emphasized that both adsorption and absorption occur with both types of resin when in contact with plasticizers. In this paper we refer to the calender operator's "dry" resin type as an adsorptive resin because of the important part that adsorption contributes to its blending characteristics. For want of a better name we can call the dry blend extrusion resin an absorptive or low adsorptivity resin.

* * *

To-date, we have classified a resin empirically by inspection of screen analysis, bulk density and behavior in the field as to its adsorptive character. This we believe is inadequate as there are many exceptions to the established rules.

* * *

The specific surface area of resin has an important bearing upon its adsorptivity characteristics. Firestone has used the following technique for measuring the specific areas of a resin.

TABLE I "LOW ADSORPTIVITY" OR "ABSORPTIVE" RESINS
(Dry Blend Extrusion or Injection Molding)

Screen Analysis	Exon 500	A	B	C	Average of Screen Apertures - Cm.
% on 60 mesh	7.2	0.1	0.6	0.1	0.0210
% on 70 mesh	5.7	0.1	0.6	1.3	0.0203
% on 80 mesh	6.2	0.4	1.8	6.8	0.0179
% on 100 mesh	10.5	32.4	4.8	35.0	0.01565
% on 140 mesh	37.0	56.0	31.0	35.0	0.01235
% on 200 mesh	20.2	10.0	29.4	16.4	0.00905
% on 325 mesh	5.8	0.8	21.4	4.8	0.00585
% thru 325 mesh	13.2	0.2	10.4	0.4	0.00215
Bulk Density g/cm³	0.48	0.49	0.52	0.37	
Ave. Particle Diameter, D, Cm	0.0125	0.0130	0.0092	0.0131	
Specific Area (A) in cm²/g	166	156	207	206	

The resins cited in Table I have a high percentage of particles on the larger screens. The bulk density of resin "C" however, would normally be too low for this classification. Experience indicates that "C" does belong in this category.

* * *

The resins cited in Table II are known in the field as adsorptive type resins. However, according to screen analysis, we would expect to see resin "D" in Table I.

TABLE II ADSORPTIVE RESINS
(Highly Plasticized, Cold Blended, Calender Type)

Screen Analysis	Exon 911	D	E	F
% on 60 mesh	0.1	0.8	0.0	0.4
% on 70 mesh	0.2	3.2	0.4	0.2
% on 80 mesh	0.6	6.8	0.2	0.2
% on 100 mesh	1.6	8.8	0.2	0.6
% on 140 mesh	23.4	21.4	8.2	1.6
% on 200 mesh	28.6	12.8	50.8	20.0
% on 325 mesh	26.8	33.0	26.0	45.2
% thru 325 mesh	18.7	13.2	14.2	31.8
Bulk Density g./cm.^{3}	0.42	0.31	0.40	0.28
Ave. Particle Diameter, D, Cm.	0.0079	0.0094	0.0076	0.0048
Specific Area (A) in cm.^{2}/g.	306	342	330	742

This indicates that inspection of screen analysis or bulk densities alone are inadequate.

* * *

The average particle diameters for these resins can be obtained as follows:

(Equation 1)

Ave. Particle Diam. $= \Sigma(D')\,(W)$

where (D') = **Size of average screen aperture**

(W) = **Weight fraction of resin on screen with average screen aperture** (D').

* * *

No correlation can be obtained from average particle diameters alone because the average particle diameter of resin "D" (an adsorptive resin) is larger than the average particle diameter of resin "B" (a low adsorptivity resin).

* * *

If we take the reciprocal of the product of the average particle diameter and bulk density, we obtain the specific area of the resin.

(Equation 2)

$$A = \left[(D)\ (\rho) \right]^{-1}$$

where D = **average particle diameter in cm.**

ρ = **bulk density of resin in grams/cm.^{3}**

A = **specific area of resin in cm.^{2}/gram.**

* * *

Now we have our first real correlation between surface area and adsorptivity. The resins with low adsorptivity have specific surfaces or areas of approximately 210 cm.^{2}/gm. or less. The resins with high adsorptivity have specific areas or surfaces of 305 cm.^{2}/gm. and higher.

* * *

Resin size and shape are believed to be the controlling factor in determining a resin's surface area. The size factor is included in the screen analysis. The shape factor is included (as a parameter) in the bulk density. It should be remembered that this technique is used to measure adsorptivity of a resin only.

* * *

Individual resin particles, under the influence of heat and plasticizer, will undergo a change in bulk density. The calender resin, as described above, (adsorptive type) usually decreases in bulk density, that is, expands in volume. The dry blending extrusion type resin (low adsorptivity) to be most effective should have as small a bulk density change as possible for good flowability.

* * *

Figures 1a and 1b show the bulk density changes encountered in a heated blender by typical extrusion and calendering resin.

* * *

In general, flowability of an unfilled plasticized blend can be related to the following:

(Equation 3)

Flowability $= f\,(\rho_B)\,(\Delta\rho)\,(f_D)\,(N_D)\,(q)\,(R)$

ρ_B = **Bulk density of resin**

$\rho_B = f$ **(gravity) for as** ρ_B **decreases, then small values of (q) state cannot be neglected.**

$\Delta\rho$ = **Bulk density change due to heat and plasticizers**

= (f) **temperature**

f_D = **Sphericity** [2] **of resin particle**

N_D = (f) **Particle size distribution and uniformity - possibly related to D of Equation 2**

q = **Static charge**

R = **Degree of plasticizer absorption**

Complete data to satisfy all the elements of Equation 3 are not available at this time. It is hoped that sufficient information will be accumulated to establish a dimensional, or perhaps, even a dimensionaless grouping that will aid in the prediction of resin flowability.

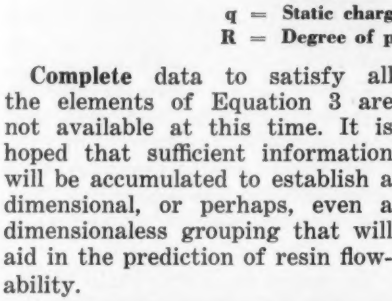


FIGURE 1a

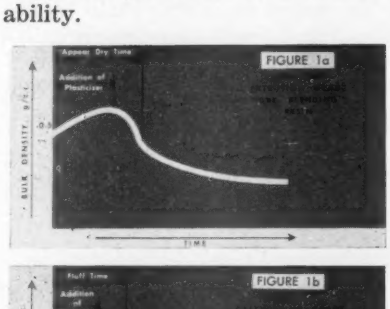


FIGURE 1b

Firestone measures **dryness,** or more exactly, an arbitrary point after adsorption and absorption have taken place, in terms of "minutes to dryness" as obtained in a heated Day Mixer.

* * *

The Day Mixer (J. H. Day Co.) is a steam jacketed-double arm mixer with a capacity of approximately 0.13 cu. ft. The rotors are tangential, unheated, and operate at differential speeds of 36 RPM and 74 RPM. Plasticizers and liquid stabilizers are loaded through the top which has a removable cover. The hot dry blend is discharged by tilting.

* * *

Our standard resin dryness formulation is as follows:

Resin	**100 parts**
DOP	**50 parts**
Co-Ppt. Ba-Cd Laurate	**2 parts**
Chelating Agent	**1 part**

* * *

Unfilled blends are required since fillers often will retain plasticizers and interfere with the end point. This end point is obtained by pressing a small sample of the hot blend to 138 psi pressure in an unheated Carver Laboratory Press between two pieces of paper. The Day Mixer dryness value is the time elapsed after the final addition of plasticizer for a stainfree paper to appear. The average temperature of the Day Mixer during the test is 210°F. Resin, plasticizer, and stabilizer are added cold to the hot mixer over a period of two minutes.

* * *

This test assures identical agitation, formulation and temperature. Of course, different values can be obtained by modifying such factors as plasticizer loadings, temperature of drier, drier agitation, pressure applied to hot sample in press, etc. We have chosen our conditions so that they are what we believe to be critical in regard to separating the overall dryness

or plasticizer adsorptivity-absorptivity characteristics of various Firestone and competitive resins. The dryness value obtained in these investigations actually indicates a "dryness" rate since the quantity of plasticizer absorbed is constant.

* * *

The Day Mixer gives us two other points of reference when evaluating "dry blending" resins. These are:

1. **The *appear dry time* or *hot flow time*, which is the initial period after the addition of plasticizer that the hot plasticized blend begins to fall freely from the mixer blades. This is the "dryness" that extruder operators use to control their blending cycles. They use *dryness* and *flowability* interchangeably. In the majority of cases, the resin is not "dry" by the pressure stain test when the first "hot flow" is observed.**
2. **The *Fluff Time*, which is the first initial period after the addition of plasticizers that a resin, usually an adsorptive type, changes (lowers) its bulk density. Again, in the majority of cases, the resin is not "dry" by the pressure stain test at this point.**

* * *

We may ask, "What is the value of the pressure stain test?" It is this: Even though a resin may appear dry or fluffy, if it still has plasticizer on the surface of its resin particles, it cannot quickly develop its maximum physical properties. This will show up perhaps as die facing on extruders, "nervy" stock on mills and calender rolls, excessive banbury fusion rates, etc. We, at Firestone, have obtained excellent correlation between the Pressure Stain Test and behavior in the field. Firestone dry blending, extrusion, calendering and injection molding resins have excellent dryness rates as obtained by the Day Mixer-Pressure Stain Test.

* * *

The physical properties of polyvinyl chloride resins are functions of their molecular weight. Unfortunately, molecular weights of high polymers of the magnitude of the resins under discussion, i.e., those with relative viscosities from 2.05 to 2.52, are very difficult to obtain. Many times, different molecular weights for the same polymers can be obtained by varying the solvent in identical evaluation systems (light scattering, viscosity, or osmotic pressure).

Firestone measures or relates the molecular weight of a resin to its relative viscosity. Over the years excellent correlations have been obtained when relating viscosity measurements to processing conditions.

* * *

Viscosity measurements lose their significance, however, when a copolymer is introduced. This means that viscosity measurements, whether relative, specific, etc., can only be compared when studying polymers of the same chemical nature.

* * *

This paper deals with effects of plasticizers in the concentrations most often encountered in the calendering, dry blend extrusion, and injection molding fields; that is, 20% to 50% by weight of plasticizer.

* * *

One of the most important factors in determining whether a plasticizer is suitable is its **compatibility** with the resin. Incompatibility will often become evident during compounding and processing by excessive blending or banbury cycles. The incompatible plasticizer, in this case, acts as a lubricant. Because many plasticizers have better compatibility at elevated temperatures, exudation in the form of "spew" or "plate out" may occur after the finished product ages at room temperature.

* * *

A plasticizer's softening action is usually attributed to its ability to reduce the intermolecular forces of the polymeric system. This can be accomplished in at least two ways:

1. **The polar groups of the plasticizer associate in some way, with polar groups of the polymer molecule. This decreases the intermolecular attraction by reducing the effective number of polar groups available. When these new polymer-plasticizer associations or attachments are strong, we have true solvent action and the plasticizers are called "solvent type".**
2. **The polar groups of the plasticizer can force the polymer polar molecules apart. Here, the physical separation is attained by sheer force. When the plasticizer-polymer attractions are negligible, we have a "'non-solvent type" plasticizer. In this case, the plasticizer is just a spacer.**

* * *

Of course, there are plasticizers that act with limited solvent action with the resin. Plasticizers generally, however, are high boiling, organic liquids or low melting solids and may exhibit varying degrees of solvent action. The main difference between them and ordinary solvents is volatility.

* * *

The solvent power of a plasticizer upon a specific polyvinyl chloride resin can be measured in a number of different ways. The heated Day Mixer, which is described earlier in this paper, is one of the methods used by Firestone.

* * *

The dryness value, as obtained by the pressure strain test, indicates the relative ease with which various plasticizers can be incorporated or blended with polyvinyl chloride resins.

* * *

The following formulation was used during this investigation:

Exon 500	**100 parts**
Plasticizer	**50 parts**
Co-ppt. Ba.-Cd. Laurate	**2 parts**
Chelating Agent	**1 part**

* * *

The tests were performed, using identical temperatures, agitation, and plasticizer loadings.

* * *

Absorptivity times for various plasticizer types are given in Table III.

* * *

It is evident from the absorptivity times as obtained from the Day Drier and given in Table III that cyclic and ring compounds are more compatible (absorbed more readily) than long straight chain type compounds. The three plasticizers whose average structural formulas are given below all have excellent plasticizer absorptivity rates. (See top of next page)

The first three plasticizers are characterized by modified benzene rings. These plasticizers have excellent dryness or absorptivity rates. The last two plasticizers are characterized by long straight hydrocarbon chains. These plasticizers have very poor dryness or absorptivity rates.

* * *

Rheological measurements have also been used to measure the solvent power of various plasticizers. Firestone has made extensive investigations of the paste viscosity characteristics of various plasticizer systems with Exon 654, a homopolymer of vinyl chloride.

TABLE III

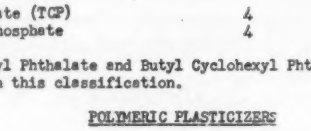
ABSORPTIVITY CHARACTERISTICS OF VARIOUS COMMERCIALLY AVAILABLE PLASTICIZERS

	Day Mixer Time - Minutes	Absorptivity	Molecular Weight of Plasticizer
MONOMERIC PLASTICIZERS			
Phthalate Type			
Butyl Cyclohexyl	4		304
Butyl Benzyl	4		312
Dihexyl	8		334
Decyl Butyl	10		362
DiOctyl	12		390
Iso Octyl Decyl	26		418
n-Octyl n-Decyl	28		418
Di iso Decyl	90+		446
Straight Chain Type			
Tri Octyl Phosphate	90+		435
Di Octyl Adipate	90+		371
Acetyl Tri Butyl Citrate	16		403
Ring Compounds			
Tri Cresyl Phosphate (TCP)	4		368
Cresyl Diphenyl Phosphate	4		340

NOTE: Butyl Benzyl Phthalate and Butyl Cyclohexyl Phthalate could also be included in this classification.

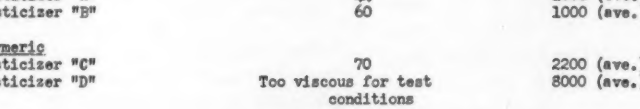
POLYMERIC PLASTICIZERS		
Epoxy-Polymeric Type		
Plasticizer "A"	44	1000 (ave.)
Plasticizer "B"	60	1000 (ave.)
Polymeric		
Plasticizer "C"	70	2200 (ave.)
Plasticizer "D"	Too viscous for test conditions	8000 (ave.)
EXTENDER-SECONDARY PLASTICIZERS		
Synthetic Hydrocarbon oil	90+	-
Glyceryl Tri-Acetate Ricinoleate	90+	-
Ester of Pentaerythritol and a saturated Aliphatic acid	90+	-

BUTYLBENZYL PHTHALATE

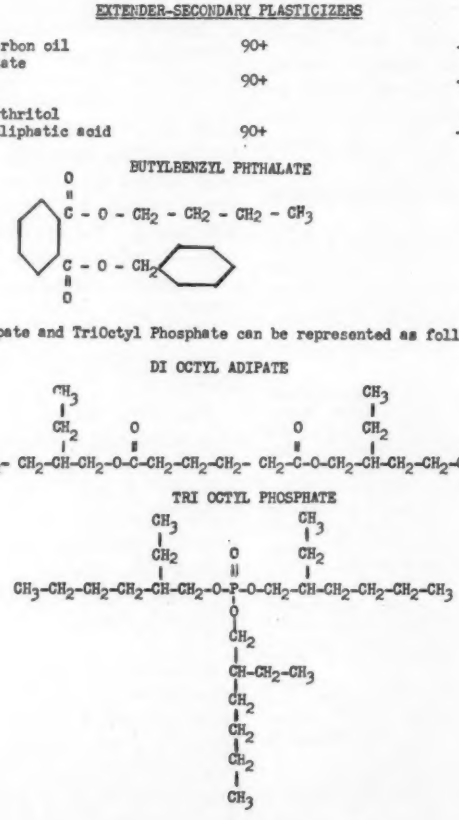


DiOctyl Adipate and TriOctyl Phosphate can be represented as follows:

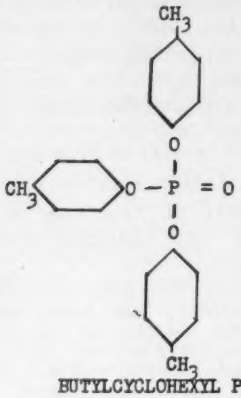
DI OCTYL ADIPATE



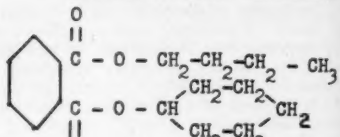
TRI OCTYL PHOSPHATE



TRI CRESYL PHOSPHATE
(Actually Triolyl Phosphate)



BUTYLCYCLOHEXYL PHTHALATE



Exon 654 is a dispersion type resin.

* * *

The initial viscosity of a plastisol is determined generally by the viscosity of the plasticizer. The viscosity stability or "shelf life" is dependent to a great extent on the solvent power of the plasticizer upon the resin. As we mentioned earlier, plasticizers such as Butyl Benzyl Phthalate, and Tri Cresyl Phosphate, which are considered solvent type, tend to increase rapidly in viscosity upon aging. "Non-solvent" or "poor solvent" type plasticizers give pastes with much better viscosity stability characteristics.

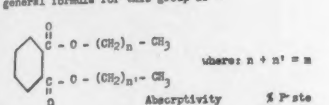
* * *

The following bar graph of various Phosphate type plasticizers shows the effect of aromatic vs. aliphatic type structures. The plasticizer with the long straight chain (with lower solvent power) i.e., Tri Octyl Phosphate, has excellent paste viscosity stability. The plasticizers which are influenced strongly by the aromatic groups, i.e., Alkyl Aryl Phosphate, Cresyl Di Phenyl Phosphate, and Tri Cresyl Phosphate are relatively poor in paste aging (i.e., increase rapidly with time). They have higher solvent power than DOP or a straight chain type of plasticizer.

* * *

Table IV shows the effect of increasing the number of — CH_2 — groups (lengthening the chain) of

TABLE IV
SOLVENT POWER VIA CHAIN LENGTH
The general formula for this group is -



Phthalate Plasticizer	(m + 2)	Absorptivity Time (Minutes)	% Paste Visc. Inc. (30 Days)
DIHEXYL	12	8	364.0%
DECYL BUTYL	14	10	146.0%
DIOCTYL	16	12	50.6%
OCTYL DECYL (Average of Iso & n-)	18	27	43.7%
DI-ISO DECYL	20	90+	40.0%

a homologous series of dialkyl phthalates. The general formula for this group is given at the top of the table. Column I cites the chemical name of the phthalate plasticizer. Column II gives the total number of CH_2 groups. Table III gives the Absorptivity Time as indicated by the Day Drier. Column IV gives the % paste viscosity increase at 30 days for a 60 phr DOP, 100 part EXON 654 blend.

* * *

As the length of the chain increases (or influence of the ring is diminished), the Day Drier absorptivity rate increases, the paste viscosity stability improves (percent viscosity increase is lower), and the solvent power and compatibility decreases.

* * *

Another indication of resin-plasticizer compatibility, in the concentrations under consideration, is the banbury fusion characteristics of the plasticized blend.

* * *

The banbury mixer is an internal type mixer capable of applying large quantities of power per unit volume.

* * *

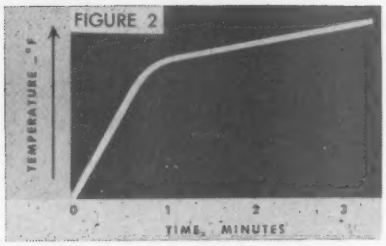
When a cold mix or dry blend is placed in an unheated banbury mixer, the heat required for fusion of the blend is obtained only from the frictional heat build up due to the high shearing action of the rotors.

* * *

A laboratory size banbury mixer with a capacity of approximately 3.5 pounds (1300 cm^3) was used for this portion of the investigation. The banbury mixer was equipped with a recording thermometer, to record themperatures of the fluxing blend, and a recording watt meter, to record power supplied to the banbury.

* * *

A typical temperature-time curve is shown in Figure 2. Blends



which increase rapidly in temperature are usually credited with fast fusion rates.

* * *

Figure 3 is a typical Power-Time curve for the banbury. A high power peak usually denotes great resistance to the banbury rotors, high frictional heat build-up and a comparable plasticizer. The work supplied to the banbury can be calculated by integrating the area under this banbury power curve. Again, high work values (usually in ft.—lbs.) denote high frictional heat build-up and compatible plasticizers.

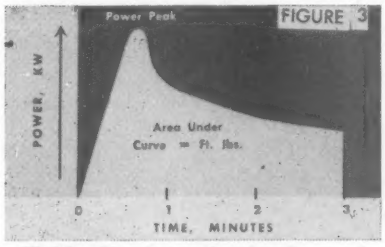


Table V gives the banbury fusion characteristics of various commercially available plasticizers. In the first portion of the table, evaluations were made on both cold mixed and dry blended samples. The dry blend samples were obtained from overnight air cooled blends obtained from the heated Day Mixer after being blended for the times cited in Table III. This means that each plasticized dry blend received a different heat history before banburying. This was done in order to determine the effects of dry blending upon banbury fusion characteristics.

* * *

The cold blended samples (in the same formulation as the dry blended sample) were Hobart mixed for 15 minutes at room temperature.

* * *

From Table V we see that the dry blended samples fuse faster, (as indicated by time to develop maximum power peak), develop higher maximum power peaks and have higher stock temperatures. They also draw more power to the banbury than the cold blended samples. This to to be expected since some of the heat developed by the cold blend is applied first to drying the blend before fusion takes place. Another factor to be considered is the lubricating effect of the plasticizer on the surface of the resin particles in the cold blended samples. This obviously will interfere with the rapid heat build-up of the cold-blended sample.

* * *

Of course, the high shearing action of the banbury mixer may tend to equal out the differences between hot and cold blended samples in some plasticizer systems. (A few plasticizers, i.e., DOP, DIDP, and TCP, obtained higher work applied values for cold mixed blends over dry blends).

* * *

The Synthetic Hydrocarbon Oil behaved exactly the opposite of what we would have expected. Behavior of plasticizers such as this, i.e., whose chemical structures are obscure, is very difficult to predict. Possible loss of plasticizer by volatilization or change in chemical structure during dry blending might cause this type of discrepancy.

* * *

The efficiency of a plasticizer refers to the relative ease with which a plasticizer will soften a polymer. Efficiency can be measured in many ways; 100% modulus, flexibility (Clark Stiffness, etc.), plasticity, low temperature properties (Clash & Berg, Cold Crack), Hardness (Rockwell, Durometer), etc.

* * *

Effects of aging should be considered when measuring efficiency. Firestone has investigated the effect of room temperature aging upon durometer hardness values of various plasticized compounds. In general, at constant temperature, plasticized compounds increase in hardness with time, i.e.:

(Equation 4)

$$H = f(T)$$

where H is durometer hardness and T is time

During the first seven (7) days aging, the curve will take the form:

(Equation 5)

$$H^2 = aT + b$$

BANBURY FUSION CHARACTERISTICS

TABLE V

Plasticizer	Max. KW	Time To Power Peak, Seconds	Power To Banbury Ft.-Lbs./3.52 Lbs. For 3 Min.	Stock Temperature °F., Seconds 45	60	90
Butyl Benzyl Phthalate						
Dry Blend	21.3	8	714,000	325	340	366
Cold Blend	16.0	18	691,000	316	330	355
DiHexyl Phthalate						
Dry Blend	24.5	18	811,000	313	330	348
Cold Blend	16.5	19	688,000	304	324	344
DiOctyl Phthalate						
Dry Blend	24.4	12	732,000	314	338	356
Cold Blend	19.5	25	761,000	308	333	351
Dilso Decyl Phthalate						
Dry Blend	17.0	10	674,000	320	352	368
Cold Blend	16.0	26	741,000	291	330	360
TriCresyl Phosphate						
Dry Blend	16.0	12	672,000	326	339	374
Cold Blend	15.5	17	694,000	311	335	364
DiOctyl Adipate						
Dry Blend	13.9	25	661,000	302	341	352
Cold Blend	13.6	33	602,000	283	324	339
Synthetic Hydrocarbon Oil						
Dry Blend	8.3	9	665,000	255	286	310
Cold Blend	11.5	7	735,000	268	288	314
Epoxy-Polymeric Plasticizer "A"						
Dry Blend	16.5	20	716,000	321	348	357
Cold Blend	16.0	31	696,000	299	343	374
Ester of Pentaerythritol and a saturated Aliphatic Acid						
Dry Blend	14.8	8	740,000	308	340	367
Cold Blend	13.3	34	686,000	288	327	361
Butyl Cyclohexyl Phthalate						
Dry Blend	23.7	8	739,000	320	343	364
Decyl Butyl Phthalate						
Dry Blend	23.0	11	692,000	340	363	380
IsoOctyl Decyl Phthalate						
Dry Blend	16.3	14	701,000	316	320	369
n-Octyl n-Decyl Phthalate						
Dry Blend	22.5	12	723,000	328	344	365
Acetyl TriButyl Citrate						
Dry Blend	15.8	12	687,000	311	330	360
Cresyl Diphenyl Phosphate						
Dry Blend	21.5	15	732,000	326	349	371
TriOctyl Phosphate						
Dry Blend	11.8	17	667,000	292	333	360
Epoxy-Polymeric Plasticizer "B"						
Dry Blend	16.8	22	720,000	315	346	370
Polymeric-Plasticizer "C"						
Dry Blend	15.5	24	721,000	333	358	384
Glyceryl Tri-Acetyl Ricinoleate						
Dry Blend	11.5	10	535,000	271	286	309

which is an equation of the 2nd degree in H (Parobolic) where a and b are constants. (See Figure 4).

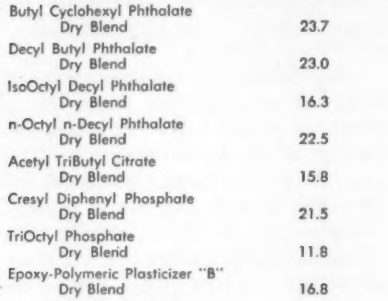


FIG. 4
DUROMETER HARDNESS
First Seven Days Aging

For longer range agings, by choosing to ignore the rapid increase of hardness during the first seven (7) days, the curve will take the form to thirty (30) days:

(Equation 6)

$$H = a'T + b'$$

which is a first degree equation in H and T (Straight line) where a' is a constant different from a in Equation 5. (It is also the slope of the curve). b' is a constant different from b in Equation 5. It is the theoretical hardness of the compound at zero time (The hardness intercept of the curve) (See Figure 5) It should be noted that Equation 3 does not hold for the first seven (7) days aging.

* * *

Other factors affecting Durometer values include: amount of plasticizer; type of plasticizer (monomeric, polymeric, epoxy, extender, etc.); aging temperature; molecular weight of resin; filler loadings; plasticizer efficiency, migration of plasticizers, etc.

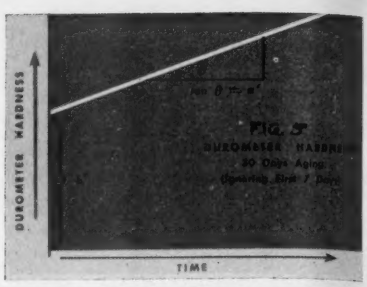


FIG. 5
DUROMETER HARDNESS
30 Days Aging

* * *

The plasticizer systems, including typical applications and evaluated constants for a Shore "A" Durometer, are given in Table VI.

* * *

The formulations used during this investigation are given in Table VII. (See next page.)

* * *

It is believed that the curve levels off after one month, i.e., slope approaches zero.

* * *

Another important property of a plasticizer is its resistance to **migration** or permanence. Many factors determine the utility of a plasticizer in this respect. Some of these factors are: vapor pressure of the plasticizer, rate of diffusion of plasticizer through the plastic, plasticizer concentration gradients of neighboring samples of air velocity when alone. It must be understood, however, that the migration or evaporation rate of a

TABLE VI

Formulation Number	Plasticizer System	First Seven Days (General Aging Curve) $H^2 = aT + b$	First 30 Days (Ignoring Initial Aging) $H = a'T + b'$	Typical Application
1	Monomeric	$H^2 = 129\,T + 7600$	$H = 0.11\,T + 90$	Clear film, clear tubing and extruded products.
2	Mixed Low temp. monomeric	$H^2 = 107\,T + 6700$	$H = 0.15\,T + 84$	Clear garden hose, clear extruded products.
3	Epoxy plasticizer	$H^2 = 105\,T + 8500$	$H = 0.09\,T + 94$	Low toxicity and low extraction.
4	Mixed monomeric polymeric	$H^2 = 96\,T + 9000$	$H = 0.07\,T + 96$	Low grease extraction.
5	Mixed primary, secondary plasticizers and filler	$H^2 = 68\,T + 8000$	$H = 0.11\,T + 91$	Wire covering, filled garden hose, gaskets.
6	Highly loaded epoxy plasticizers and low absorptivity fillers	$H^2 = 138\,T + 4800$	$H = 0.21\,T + 73$	Refrigerator gaskets.
7	Highly loaded epoxy plasticizers and highly absorptive fillers	$H^2 = 109\,T + 5600$	$H = 0.15\,T + 77$	Refrigerator gaskets.

H = Durometer Hardness, Shore "A" Scale

TABLE VII

Formulation No.:	1	2	3	4	5	6	7
Formulation Type:	Monomeric	Mixed Low Temp. Monomeric	Epoxy	Mixed Monomeric And Polymeric	Mixed Primary, Secondary Plasticizers And Filler	Highly Loaded Epoxy Plast. & Low Absorb. Filler	Highly Loaded Epoxy Plasti. and Highly Absorb. Filler
Exon 915	100	100	100	100	100	100	100
Co.-ppt.Ba.-Cd. Laurate	2	2	2	2	2	2	2
Chelating Agent	1	1	1	1	1	1	1
DOP	50	10		10	35		
DiOctyl Adipate		40					
Plasticizer "B"			50			80	80
Plasticizer "H"				40			
Synthetic Hydrocarbon Oil					15		
Auxiliary Low Temp. Plasticizer					15		
Atomite						30	
Clay					30		30

plasticizer cannot be related directly to its vapor pressure.

* * *

Monomeric aliphatic esters, such as DiButyl Sebacate and the alkyl phosphates are poor with regard to migration. The polyesters and aromatics such as Tri-tolyl Phosphate, and similar Phthalates are good in this respect. In general, long straight chains are poor while ring or cyclic compounds are good with respect to resistance to migration.

* * *

Flammability may become an important consideration under certain service conditions. As a general rule, chlorinated compounds, phosphates, and polyester plasticizers materially reduce burning rates of plasticized PVC compounds.

* * *

To the vinyl fabricator, the **heat sealing** properties of vinyl film are important. It has been found that secondary plasticizers may interfere with electronic heat sealing of calendered sheets. This is attributed by many to the poorer compatibility of the secondary plasticizers.

* * *

Table VIII shows the effect of different plasticizer systems upon the physical properties of various straight polyvinyl chloride EXON resins.

* * *

Table IX shows the aging characteristics of the plasticizers evaluated in Table VIII.

Description of Test Methods

Table VIII, Column A: Clark Stiffness

The Clark Stiffness tester measures the flexibility or stiffness of an 0.020" film cut to 2" x 6". The end of each specimen is aligned with the end of the spindle jaws and the overhanging length ad-

TABLE VIII

PHYSICAL PROPERTIES OF VARIOUS PLASTICIZED EXON RESINS

Exon Resin	(A)* Clark Stiffness (On.) Exon 915	(B)* Clash & Berg T_f, °C. Exon 915	(C)* Hardness, Durometer Shore C After 1 Week Aging Exon 500	(D)* Specific Gravity of Plasticizer
MONOMERIC PLASTICIZERS				
Phthalate Type				
Di Octyl Phthalate	7.92	-25.6	64	0.986
Di Hexyl Phthalate	7.85	-15.7	81	1.007
Octyl Decyl Phthalate	8.30	-23.5	66	0.971
Di-2-ethyl hexyl hexahydro Phthalate	7.49	-23.8	—	0.959
Di(2-ethyl hexyl) tetrahydro Phthalate	7.95	-23.5	—	0.969
Butyl Cyclohexyl Phthalate	7.72	-11.3	80	1.078
Butyl Benzyl Phthalate	6.85	-19.1	67	1.116
Phosphate Type				
Tri Cresyl Phosphate	7.75	- 9.85	92	1.166
Cresyl Diphenyl Phosphate	7.30	-12.0	79	1.208
Alkyl Aryl Phosphate	7.40	-21.5	—	1.090
Tri Octyl Phosphate	8.60	-37.4	61	0.926
Glycol Derivatives				
Butylphthalyl butyl Glycollate	7.44	-17.5	—	1.097
Triethylene Glycol Di-(2-ethyl hexoate)	7.92	-26.9	—	0.968
Polyethylene Glycol Di-(2-ethyl hexoate)	7.50	-30.6	—	0.989
Di propylene Glycol Di benzoate	7.45	-10.9	—	1.127
Low Temperature Type				
Di Octyl Adipate	7.98	-38.2	54	0.927
Di Octyl Azalate	7.69	-41.4	—	0.918
Di Octyl Sebacate	8.20	-37.8	—	0.911
Tetrahydrofurfuryl Oleate	8.25	-34.8	—	0.928
Monomeric Ester	7.35	-37.5	—	0.901
Miscellaneous				
Acetyl Tributyl Citrate	7.40	-23.9	62	1.048
2,2'(2-ethyl hexamido) Diethyl Di (2-ethyl hexoate)	8.00	-20.7	—	0.956
Tetrabutyl Thiodisuccinate	7.96	-19.0	—	1.054
POLYMERIC PLASTICIZERS				
Epoxy Type				
Plasticizer "A"	7.95	-17.9	72	0.993
Plasticizer "B"	8.00	-21.3	74	0.991
Plasticizer "E"	7.05	-23.5	—	0.998
Plasticizer "F"	7.59	-35.2	—	0.909
Plasticizer "G"	8.75	-19.2	—	0.990
High Molecular Weight Type				
Plasticizer "H"	8.47	-11.2	—	1.10
Plasticizer "J"	8.02	-10.2	—	1.055
Secondary Type				
Synthetic Hydro Carbon Oil	10.1	- 8.65	100+	0.954
High boiling liquid Hydro Carbon @ 37.5 PHR-DOP; 12.5 PHR-Plasticiser	7.90	-16.25	-	1.004
Auxiliary Low Temperature Plasticizer @ 35 PHR-DOP; 15 PHR-Plasticizer	7.80	-27.0	-	0.943
Glyceryl Tri Aceto Ricinoleate @ 40 PHR-DOP; 10 PHR-Plasticizer	8.25	-21.0	84	0.967

*Refer to Description of Test Methods.

TABLE II

AGING CHARACTERISTICS OF VARIOUS PLASTICIZED EXON RESINS

Exon Resin	(A)* Heat Stability @ 180°C. (Minutes) Exon 915	(B)* Sunlamp, Weeks Exon 915	(C)* FADE-O-METER (Hrs.) Exon 915	(D)* Migration, % Loss @ 25 Days Exon 900A
MONOMERIC PLASTICIZERS				
Phthalate Type				
Di Octyl Phthalate	90+	8+	500+	8.4
Di Hexyl Phthalate	90	4	500	8.9
Octyl Decyl Phthalate	90+	8	400	12.9
Di-2-ethyl hexyl hexahydro Phthalate	90	4	500	10.0
Di(2-ethyl hexyl) tetrahydro Phthalate	90	3	200	11.9
Butyl cyclohexyl Phthalate	90+	8	500	6.1
Butyl bensyl Phthalate	90+	5	400	8.0
Phosphate Type				
Tri Cresyl Phosphate	60	1	200	9.9
Cresyl Diphenyl Phosphate	90	2	300	6.3
Alkyl Aryl Phosphate	30	1	300	10.1
Tri Octyl Phosphate	30	8	400	17.4
Glycol Derivatives				
Butyl phthalyl butyl Glycollate	90	3	500	—
Triethylene Glycol Di-(2-ethyl hexoate)	90	3	500	16.6
Polyethylene Glycol Di(2-ethyl hexoate)	60	4	500	15.5
Dipropylene Glycol Dibensoate	90	5	400	—
Low Temperature Type				
Di Octyl Adipate	90+	8+	500+	16.3
Di Octyl Azelate	90	8+	500	—
Di Octyl Sebacate	90	8	300	17.0
Tetrahydrofurfuryl Oleate	90+	3	300	16.0
Monomeric Ester	90	5	500	—
Miscellaneous				
Acetyl Tri Butyl Citrate	90	5	400	10.0
2,2'(2-ethyl hexamido) Di ethyl Di(2-ethyl hexoate)	30	Less than 1	300	8.8
Tetrabutyl Thiodisuccinate	30	1	100	9.0
POLYMERIC PLASTICIZERS				
Epoxy Type				
Plasticizer "A"	90+	6	500	8.5
Plasticizer "B"	90	6	500+	—
Plasticizer "E"	90+	7	500+	—
Plasticizer "F"	90+	7	500	—
Plasticizer "G"	90+	5	400	10.4
High Molecular Weight Type				
Plasticizer "H"	90+	7	500	—
Plasticizer "J"	90	7	500+	—
SECONDARY TYPE				
Synthetic Hydrocarbon Oil	90	Less than 1	Less than 100	4.0
High boiling liquid Hydrocarbon Oil @ 37.5 PHR-DOP; 12.5 PHR-Plasticizer	90	1	100	8.5
Auxiliary Low Temperature Plasticizer @ 35 PHR-DOP; 15 PHR-Plasticizer	90	2	400	—
Glyceryl Tri Aceto Ricinolate @ 40 PHR-DOP; 10 PHR-Plasticizer	90	1	200	—

*Refer to Description of Test Methods.

justed so that when the spindle is rotated to the left and to the right, the combined angles through which the specimen will just fall through the vertical is 90°. The overhanging length is then measured to the nearest 0.5 mm. Therefore, the longer the specimen, (i.e., higher stiffness value in cm.), the less flexible the specimen. The formulation used for this evaluation was:

Exon 915	**100 parts**
DOP	**25 parts**
Plasticizer under evaluation	**25 parts**
Stabilizer (Ba, Cd, Epoxy, Organic)	**4.5 parts**

Table VIII, Column B: Clash & Berg, Tf, °C.

The apparatus and technique are as described in ASTM D1043-51. The results are recorded in °C., which is the temperature that an 0.040" specimen will twist in a 200° arc under a standard load. (Torque of 5.68 X 10^5 dyne-cm.). Naturally, a low Tf value would indicate good low temperature flexibility. The formulation used for this evaluation was:

Exon 915	**100 parts**
DOP	**25 parts**
Plasticizer under evaluation	**25 parts**
Stabilizer, (Ba, Cd, Epoxy, Organic)	**4.5 parts**

Table VIII, C: Hardness

The hardness test is performed on a dry blended sample from the Day Mixer (See Part II), that has been banburied for 3 minutes and mill stripped. The mill strip sample was then press polished to a thickness of ¼ inch, aged for one week, and measured for hardness using a Shore "C" scale Durometer. The value obtained is the average of 10 instantaneous readings.

* * *

The formulation was as follows:

Exon 500	**100 parts**
Plasticizer	**50 parts**
Co-ppt. Ba-Cd Laurate	**2 parts**
Chelating Agent	**1 part**

Table VIII, Column D, Specific Gravity of Plasticizer

The values given are those most often cited by plasticizer manufacturers in their literature. They should be used as guides only (not absolute values), because of slight differences in temperatures of evaluation and purity of compounds.

Table IX, Column A: Heat Stability

The value cited refers to the time for the appearance of a strong yellow or deep brown color by an 0.025 inch mill strip sample in a convection oven at 180°C. The specimen was milled at 300°F. for four (4) minutes.

The formulation used was:

Exon 915	**100 parts**
DOP	**25 parts**
Plasticizer under evaluation	**25 parts**
Stabilizer, (Ba, Cd, Epoxy, Organic)	**4.5 parts**

Table IX, Column B: Sunlamp

The sunlamp consists of a bank of five (5) G.E. S-1 lamps mounted in a circle. The specimens are mounted on a circular rotating table (2-3 RPM) 12 inches below the lamps. The value cited refers to the time in weeks for the appearance of a strong yellow or deep brown color to appear. No note of "spew" or the appearance of "tack" are included in this investigation. The formulation used was:

Exon 915	**100 parts**
DOP	**25 parts**
Plasticizer under evaluation	**25 parts**
Stabilizer, (Ba, Cd, Epoxy, Organic)	**4.5 parts**

Table IX, Column C: FADE-O-METER

The Atlas FADE-O-METER, type FDA-R, is a self-contained electrically operated device for

(Please turn to page 1160)

Enjaco Corporation Designs New Integral Ribbon Cable Equipment

With flat ribbon cable coming into ever-increasing use for many application, the need for specifically designed, efficiently engineered production equipment has become more and more urgent.

* * *

The Enjaco Corporation, formed at the turn of the year through the merger of the **James L. Entwistle Company** and **The Federal Manufacturing Company,** has just completed, tested and shipped the first unit of its new line of integral Ribbon Cable Equipment.

* * *

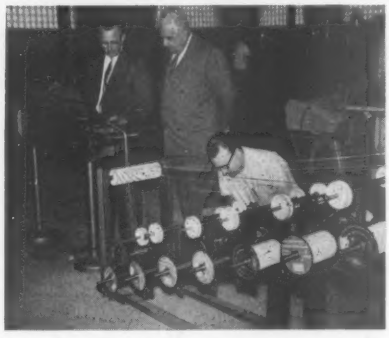
The new equipment improves flat cable manufacturing, and permits uniform quality control at efficient production speeds, a "must" in fabricating this "cable of the future".

* * *

This first equipment is capable of handling up to sixteen conductors in varied sizes of single conductor or twisted-pair. Other units may be had for processing a larger number of conductors on a single plane, or for producing multi-layer flat cable.

* * *

The entire equipment consists of a tension-controlled multi-head pay-off, a coating tank operated with a cold solution which fuses the individual conductors together into monolithic flat cable, a temperature controlled, electric drying oven which completes the processing of the cable, an optional water cooling tank, a constant ft./min. capstan, a side-entrance measuring machine with pre-determined counter to control output, and a double-head pancake coiler with torque control. A traversing coiler is available if preferred. Both capstan and coiler are variable-speed. In use, the individual wires in the cable can be easily separated for connection without injury to the insulation.



Enjaco's Ribbon Cable Equipment

* * *

It is reported that considerable interest in the new equipment has been shown throughout the industry during the past three months, and that numerous requests for advice on the integration of the new production system have been received.

New Testing Machine

The Alpha Lubricant-Friction-Wear testing machine (Model LFW-1) has been modified to add two new testing speeds, it was announced by **The Alpha-Molykote Corporation.**

* * *

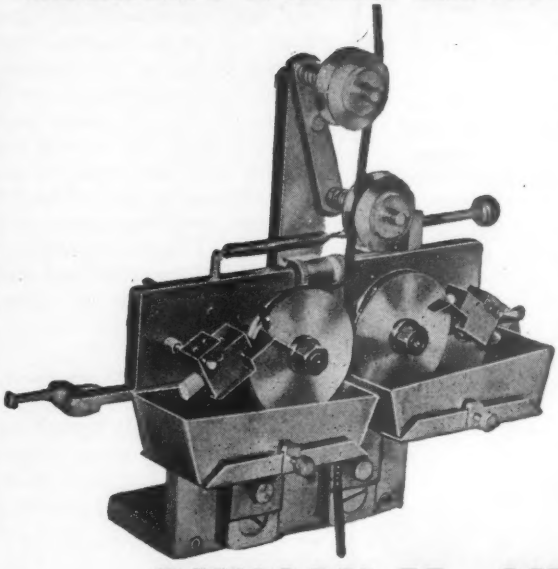
The new speeds serve to increase the original multi-speed operating

LEGEND LARGE AND CLEAR ON INSULATED WIRE SURFACES —— USE GILLIES MARKING

GILLIES CONCAVE AND FLAT MARKING WHEELS PRINT YOUR

WHEELS AND MACHINES FOR BEST WIRE IDENTIFICATION

MARKING WHEELS and MACHINES for ELECTRIC WIRE



Gillies Engraved Concave and flat marking wheels are widely used printing the I.P.C.E.A. color code, numerical, semi-spiral striped, dating, or manufacturer's identification, etc. on insulated wire, tubing or hose.

Machines print on ONE or BOTH SIDES in large legible letters. Wheels are adaptable to any machine—or we will supply the machines.

Wheels, shafts, ink pans and all accessories are readily removable for quick and easy cleaning.

Wheels are made of TOOL STEEL, HARDENED to Rockwell test 61-64 and HARD CHROME PLATED.

Send for samples of wire and prices on wheels and equipment.

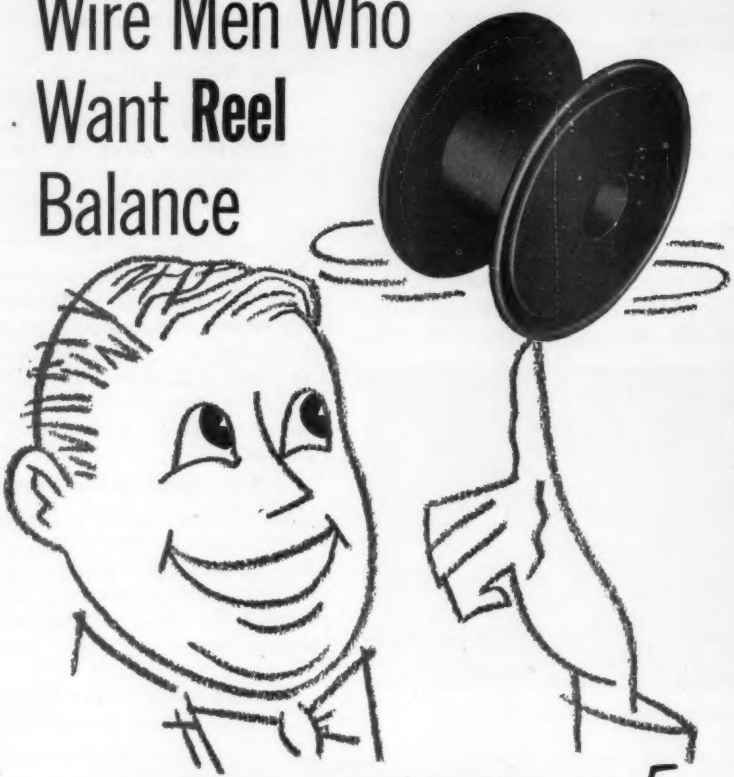
"There is no substitute for QUALITY when combined with SERVICE"

DUNCAN M. GILLIES CO., INC.

P. O. BOX 181, WEST BOYLSTON, MASS.

Telephone: TE 5-4445

Wire Men Who Want **Reel** Balance



Turn to **APCO MOSSBERG** *First*

Close tolerances make a big difference in high speed wire processing. That's why Apco Mossberg steel reels, spools and bobbins are custom-designed to meet your *exact* specifications in size, shape, balance and trueness.

Apco's precision all-steel construction assures smooth spool-out without wire breakage or trapping . . . keeps machine downtime to the minimum . . . keeps your production rate up to date. What's more, you get a strong, safe, wire-processing package that pays off in substantial on-the-line economies.

Wire, write or phone collect for preliminary recommendations. If it's reel balance you want, Apco Mossberg has the answer that makes real sense.

PACIFIC COAST REPRESENTATIVE:
Gordon Proffitt
World Trade Center
Ferry Building
San Francisco 11, California

CANADIAN REPRESENTATIVE:
Hugh P. Williams & Co.
47 Colburne Street, West
Toronto, Ontario, Canada

APCO MOSSBERG COMPANY
LAMB STREET, ATTLEBORO, MASSACHUSETTS

range of the machine in two directions. Originally manufactured with testing speeds of 35, 72 and 120 R.P.M., the Model LFW-1 is now available with a 12-½ R.P.M. speed on the low side and a 200 R.P.M. speed on the high side of the range. In friction and wear testing, velocity is the key variable and the newly-increased testing speed range of the Model LFW-1 makes possible more complete studies of this variable.

* * *

For more complete details, write The Alpha-Molykote Corporation, 65 Harvard Ave., Stamford, Conn.

Expansion At Firth Sterling

Firth Sterling Inc. has commenced construction of new melting facilities and a new building to house its newly acquired Hopkins (Kellogg) Process.

* * *

The building, located at Firth Sterling's McKeesport, Pa., plant site, will be of heavy steel frame construction 50 feet high to provide crane service over the furnaces. Approximately 11,500 square feet of manufacturing area with 1,500 square feet of office space are involved.

* * *

Melting facilities will consist of four melting machines, three of which will be transferred from the Kellogg plant in New Jersey. The machines are capable of producing ingots up to 15 inch diameter weighing 3300 lbs. A new melting machine will be installed capable of producing ingots up to 20 inch diameter weighing approximately four tons. The new melting facilities will have a combined capacity of 800,000 pounds of metal per month.

* * *

The Hopkins Process is a technique for producing ultra-pure alloys by consumably remelting electrodes of desired alloy composition by striking an arc through a purifying slag in a water cooled copper crucible.

Our Advertisers are Reliable.
Patronize Them.

New Technical Bulletin Issued by Riverside-Alloy

A revised edition of Technical Bulletin T-3, containing the latest basic technical data on Nickel-Clad Copper Wire, has been published by **Riverside-Alloy Metal Div., H. K. Porter Co., Inc.** It is designed to serve as a handy reference guide to the properties, advantages and applications of Nickel-Clad Copper Wire. Two easy-to-read charts show the mechanical and electrical properties of the bi-metal. It also includes photographs of typical applications.

* * *

Copies of the new folder are available upon request from: Riverside-Alloy Metal Division, H. K. Porter Company, Inc., Publications Section, Riverside, New Jersey.

New Dimensional Standards For Rivets

The Tublar and Split Rivet Council today announced publication of a new industrial guide on "Dimensional Standards for Semi-Tubular Rivets.

* * *

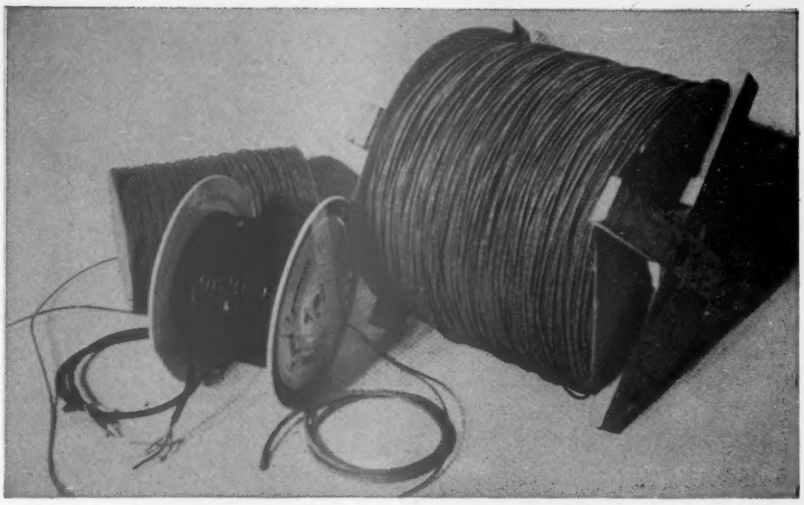
Designed to facilitate the work of industrial rivet users, this new guide contains standards data on all major classes of semi-tubular rivets. It includes, for the first time in an easy-to-read chart form, such information as body and head diameters, head thicknesses and radii, and hole diameter and depth figures.

* * *

This guide was prepared by a special Engineering Committee under the direction of **Vincent L. Bradford,** president of the **Milford Rivet and Machine Co.,** Milford, Conn. Other members of the committee included **Ralph Battles** of the Judson L. Thomson Mfg. Co., **B. C. Edmands** of the Tubular Rivet and Stud Co., **Paul E. Horst** of the Townsend Co., **E. J. Maitre** of the National Rivet and Mfg. Co., and **E. J. Morrissey** of the Chicago Rivet and Machine Co.

* * *

Copies of "Dimensional Standards for Semi-Tubular Rivets" are available free of charge from the Tubular and Split Rivet Council, 53 Park Place, New York 7, N. Y.



For High Tensile Strength, Specify

TEXTILENE GLASCOR*

Soft, dry fillers for portable and flexible cords, Textilene Glascor and Twi-Port have wide acceptance. Fiberglas-centered Glascor is exceptionally strong without added bulk or sacrifice of pliability. It goes into S, SJ, and SV cords with 18, 16, and 14 gauge conductors — Twi-Port into S and SJ cords with 12 gauge and larger conductors. Successful applications include control, appliance, and power cables; telephone drop wire; communications and coaxial cables.

Twitchell's superior Textilene line also includes: Fungus-resistant filler — *Twi-Tar.* Used for buried communications cable, expanded ACSR cable, and in other applications.

Moisture-resistant fillers—*Twi-Flex* and *Twi-Wax.* Used for nonmetallic sheathed cable, maritime shipboard cable, varnished cambric cable.

*Patent No. 2832190

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Assured supply from a reliable domestic source . . . always available in economical and convenient packaging.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation—also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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Twisted • Folded • Pressed • Crushed • Shaped • Braided • Woven

EFFICIENT, MODERN SYSTEMS FOR ELECTRICAL WIRE & CABLE MANUFACTURING

• ***CABLE LACQUERING SYSTEMS***

Conventional cellulosic, or other type, lacquers are applied in successive continuous coats from one to twenty-eight coats over fibrous braid wrapped primary conductors. One end, four ends, or eight ends of wire are handled continuously. System includes letoff, application, drying and constant tension takeup equipment.

• ***WIRE ENAMELING SYSTEMS***

Natural and synthetic enamels, silicones, solution nylon, modified plastisol, and similar insulating coatings are applied to bare, cotton or glass covered wire in round, square or rectangular cross section. Ten or twenty simultaneous strands are handled. Systems are complete with letoff, preannealer, application system, capstan and multiple takeup unit.

• ***ASBESTOS INSULATING SYSTEMS***

Carded asbestos is applied to continuous single conductor as an integrated operation with saturating, rotary forming, drying, cooling and polishing of the finished wire. Wire from No. 20 gauge to No. 6 AWG is handled through an asbestos wall thickness range of from .008″ to .040″ thickness in a single pass.

• ***RUBBER OR PLASTIC JACKETING SYSTEMS***

Rubber and thermoplastic jacketing compounds are continuously applied to electrical wire or cable by the extrusion method. High speed, constant tension letoff and takeup equipment, controlled cooling or continuous vulcanizing equipment are powered by synchronized range drives as complete, integrated wire handling systems. Extrusion machines of customer's choice are furnished.

• ***GLASS & VARNISH COATING SYSTEMS***

Double layer of glass or cotton wrapping is applied to round, flat or square conductor. Two individual coatings of high temperature varnish are applied and the finish baked in a continuous operation. Units are complete from letoffs to takeup frames.

• ***SELF TRAVERSING REEL CORD DRYERS***

These ingenious machines are used to remove hygroscopic moisture from fibers, braided or knitted flexible cable. These machines increase extrusion speeds, reduce blister scrap loss and improve diameter control. They are easily installed in existing extrusion line.

TECHNICAL INFORMATION ON ANY OF THESE PROCESSES UPON REQUEST

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235-239 BROOKPARK ROAD

CLEVELAND 9, OHIO

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TABLE OF SIZES, WEIGHTS AND LENGTHS OF COPPER WIRE

Anon. Indian Wire Ind Journ 1959 Vol 11 (3) p 45 (Mar)

HIGH-SPEED DRAWING OF CARBON STEEL WIRE

W. Holloway jun. Wire Industry 1959 Vol 26 (304) pp 353-355 357 (Apr)

Factors in speeding up the drawing of carbon steel wire are considered. The design features of the drawing machines, the cleaning and coating of the wire, the lubricant, Wyrax soap compound, and the paying-in of the wire are described. Production figures are given, and the increase in efficiency is estimated. 2 illustr, 4 tables.

THE ADVANTAGE OF PHOSPHATE-COATING IN COLD WORKING

W. Rausch, H. Fleischhauer. Indian Wire Ind Journ 1959 Vol 11 (3) pp 38-44 (Mar)

Phosphate-coating in wire drawing and its effect on die life is one of the aspects dealt with.

TORSIONAL STRENGTH OF SMALL-DIAMETER WIRE

Anon. Techn News Bull 1959 Vol 43 (1) pp 5-6 (Jan)

SOME INFORMATION ON DIAMOND DIES.

Diamantziehsteine W. Lier. Wire Ind 1959 Vol 26 (302) pp 147-148 (Feb); Draht Welt 1959 Vol 45 (3) pp 164-165 (Mar); abstr Ind Diamond Abstr 1959 Vol 16 p A46 (Mar) (In German, original in English)

HISTORY OF THE TUNGSTEN FILAMENT LAMP

J. A. Moore. GEC Journ 1958 Vol 25 (4) pp 174-188 (Oct)

The wires most commonly used in lamps for general lighting service vary in diameter from 0.015 mm for the HV 15 w lamp, to 0.05 mm. These wires must be accurately round with local variations in diameter not greater than 1%. Extreme accuracy must therefore be maintained in the diamond dies used to draw the wire. Filament size is usually controlled by weighing fixed lengths of wire, cut in special gauges, on a high precision torsion balance. 24 illustr, 2 tables.

OILS FOR THE WET-DRAWING OF WIRES

Chas. H. Windschuegel Ltd, London EC 3. Engs Digest 1959 Vol 20 (3) p 126 (Mar)

SOME INFORMATION ON DIAMOND DIES

W. Lier. Wire Industry 1959 Vol 26 (302) pp 147-148 (Feb)

Early literature on the orientation of diamonds is referred to, which leads to the conclusion that the least wear in a diamond drawing die will occur if the hole is drilled perpendicular to an octahedral plane. It was found that by taking the total drawing capacity of a die drilled along the two-fold axes of symmetry as a figure of 100, then comparable wear occurred in dies drilled along the four-fold axes after drawing 108, and in dies drilled along the three-fold axes after drawing 126.5. These results were obtained from diamonds oriented at sight. After orientation by x-ray diffraction, it was found that the total drawing capacity of dies drilled along the three-fold axes amounted to 188, compared to 100 for dies drilled according to the two-fold axes and oriented by the same means.

A table of diameter tolerances is given, and recommendations are made for optimum exit angles. 4 illustr.

THE FUNDAMENTALS OF WIRE DRAWING

J. G. Wistreich, Metallurgical Revs 1958 Vol 3 (10) pp 97-142; Battelle Techn Rev—Abstr 1958 Vol 7 (12) p 822a (Dec) (No 16192)

Mechanics; effects of heat and temperature; wire finish, friction, and die wear; lubrication; wire properties.

DIAMENSIONAL MEASUREMENTS AND FORM CONTROL OF THE SECTION OF SMALL DIAMETER METAL WIRE.

Misure della dimensione e controllo della forma della sezione di un filo metallico di piccolissimo diametro.

U. CASIMIRO. Macchine 1958 Vol 13 (6) pp 545-552 (June) (In Italian) 9 illustr. 4 tables.

THOUSAND TIMES FINER THAN A HAIR

L. Grinilev.Nauki i zhizn' 1958 Vol 25 (9) p 69 (Sep); Library of Congress Mthly Index Russ Access 1959 Vol 11 (10) p 3185 (Jan) (Original in Russian)

COMBINED ELECTRO-MECHANICAL DRILLING PROCESS FOR DIAMONDS USED IN TOOLS

Kombiniertes elektrisch-mechanisches Bohrverfahren fuer Werkzeugdiamanten.

US Nat Bur Standards. Ind Diamond Rev 1958 Vol 18 (216) pp 214-215 (Nov); abstr Industriekurier 1959 Vol 12 (14) p 45 (Jan 28) (In German)

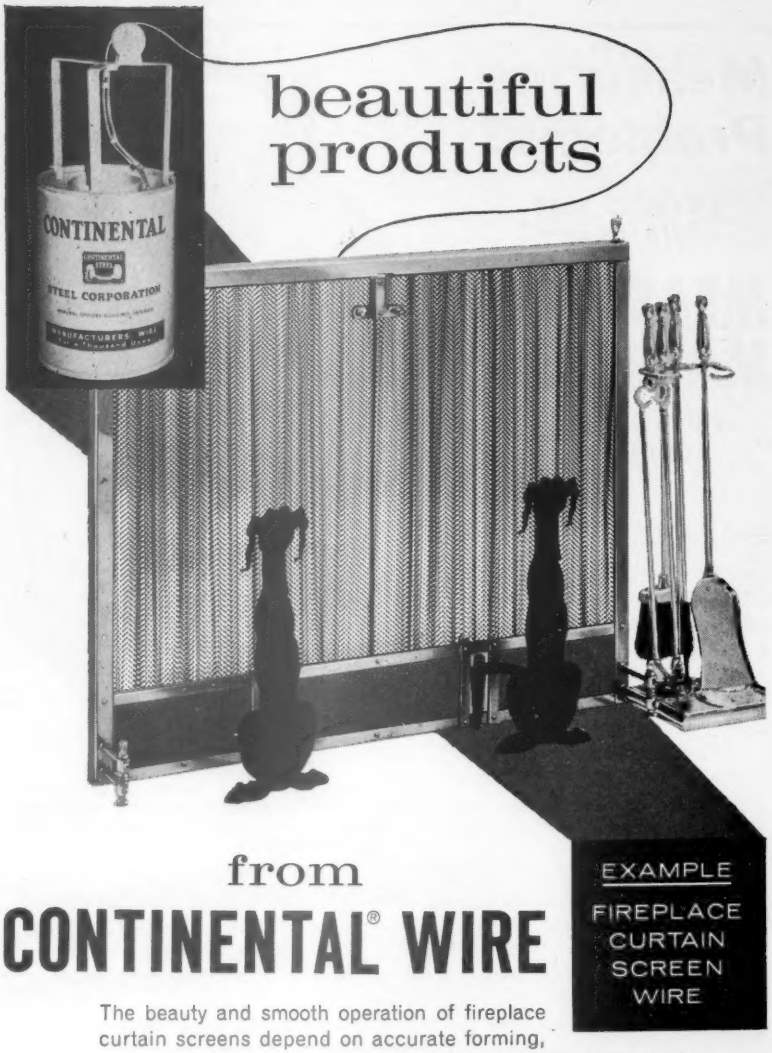
See Ind Diamond Abstr 1958 Vol 15 p A197 (Dec)

ELECTRICAL DIAMOND DIE DRILLING

Anon Wire Ind 1958 Vol 25 (298) pp 963, 977 (Oct); Ind Diamond Rev 1958 Vol 18 (216) pp 214-215 (Nov); abstr Ind Diamond Abstr 1958 Vol 15 p A197 (Dec)

MACHINES FOR PRODUCTION AND USE OF WIRES IN THE 1959 LEIPZIG TECHNICAL FAIR

Maschinen fuer die Drahtbearbeitung and Drahtverarbeitung auf der Technischen Messe 1959 in Leipzig.



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CONTINENTAL® WIRE

The beauty and smooth operation of fireplace curtain screens depend on accurate forming, even spacing, and neat appearance of the mesh. The wire used must be of correct temper, diameter and finish. Uniformity of these properties is of prime importance. Leading fireplace equipment makers choose Continental Wire because it possesses these features dependably, in coil after coil. The ability to take intricate forming is an important reason why Continental Wire is specified for scores and scores of other products made with wire. Continental Curtain Screen wire, 19 gauge through 20 gauge inclusive in size, is available in 500 pound to 650 pound catchweight single length coils packed in Leverpac Drums for faster weaving with less down time, cleaner handling and better storage. For wire in practically any size, finish, temper or analysis, in low or medium low carbon steels, see Continental first!

Fine Finishes in Manufacturers' Wire

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PRODUCERS OF: Manufacturers' Wire in many sizes, tempers and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright and special shaped wire. Also Welded Wire Reinforcing Fabric Nails, Continental Chain Link Fence, and other products.

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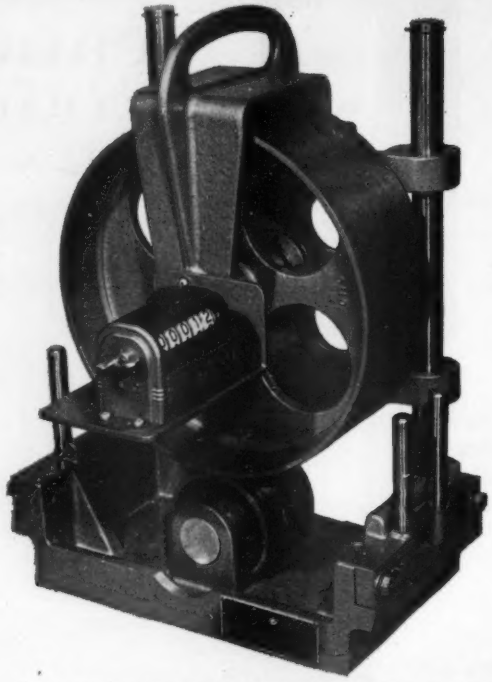
ENJACO HAS THE EXACT

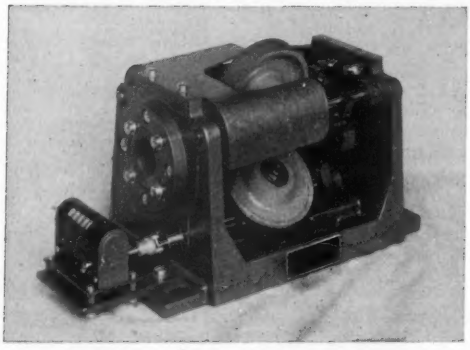
MEASURING MACHINES

TO SOLVE THEM ALL!

Whatever the size or type of your wire or cable, or the production measuring speeds necessary, there is an Enjaco Measuring Machine especially designed to fit your requirements perfectly.



Enjaco Two-Wheel Measuring Machine Class C, Type C, 3½" O. D. wire capacity. Entire measuring assembly slides on hardened steel guide rods, keeping wheels in exact vertical alignment, and giving accurate measurement of various diameters without adjustment.



Enjaco Three-Wheel Measuring Machine, Class H, Type HS, 1" O. D. wire capacity for accurate, high-speed measurement of single-conductor and twisted-pair. Model illustrated is equipped with small, high-speed, knob-reset counter, heanium wire guide bushings, and aluminum wheels with steel-sprayed rims.

- SINGLE-WHEEL CAPSTAN TYPE, 2-WHEEL OPEN-SIDE-LOADING, AND 3-WHEEL MODELS FOR MEASURING EVERYTHING FROM THE SMALLEST SINGLE-CONDUCTOR WIRE TO THE LARGEST ARMORED CABLE OR WIRE ROPE.
- SPEEDS UP TO 2,500 FEET-PER-MINUTE.
- A WIDE VARIETY OF WHEEL SURFACES TAILORED EXACTLY TO YOUR NEEDS.
- AUTOMATIC PRESSURE REDUCTION ON SMALL WIRES.
- RIGHT ANGLE, PARALLEL, OR REMOTE-MOUNTED MECHANICAL, ELECTRICAL OR ELECTRONIC COUNTERS.
- OPTIONAL EXTRAS . . . BRAKES, YARD OR METER MEASUREMENT, TACHOMETERS, CABLE ROLL GUIDES, SCRAPERS, STANDS, AND FLEXIBLE SHAFT ASSEMBLIES.

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PHONE HOPKINS 7-8411 CABLE "JALENCO" PROVIDENCE

Anon. Draht-Welt 1959 Vol 45 (5) pp 304-313 (May) (In German) 23 illustr.

LARGE-QUANTITY PRODUCTION OF SPECTACLE-FRAME REINFORCING WIRES

Change Wares Ltd, Garth Rd Morden, Surrey. Machinery (London) 1959 Vol 94 (2427) pp 1146-1149 (May 20) 7 illustr.

A STUDY OF THE CAPACITY OF MULTI-STAGE WIRE-DRAWING MACHINES

L. Godecki. Hutnik 1958 Vol 25 (9) p 346; Wire Ind 1959 Vol 26 (305) p 468 (May) (Original in Czech) 3 illustr.

THE ELECTRO-SPARK MACHINING OF WIRE-DRAWING DIES

H. G. German. Wire Production 1959 Vol 7 (9) pp 1, 3, 4-8 (Mar-Apr)

The manufacture of electrodes and the spark erosion process are described. The process is suitable for forming tungsten carbide dies. 18 illustr.

THE WEAR OF DIAMOND DRAWING DIES.

Der Verschleiss von Diamantenziehsteinen

A. J. van der Wagt. Draht 1959 Vol 10 (5) p 216 (May) (In German)

A theory has been put forward that the wear of a diamond drawing die varies with the orientation of the stone. The wear will be least when the drawing channel passes perpendicular to an octahedron face. Experiments were performed with diamond drawing dies oriented in three different ways; the very slightest deviation from accuracy in boring can cause great inaccuracies in results obtained. It was found that exact orientation can be achieved by means of x-ray diffraction, and the performance of dies in various orientations can be compared accurately. The diamond is set in a holder and examined by x-ray diffraction, being turned round until a triangular symmetry appears on the x-ray screen. This is the position in which it should be set for boring. In this way the life of a diamond drawing die can be improved by an average of 67%. 1 illustr, 1 table.

MACHINES FOR THE WIRE INDUSTRY.

Maschinen fuer die Drahtindustrie

F. W. Winter. Industriekurier 1959 Vol 12 (77) pp 253-254 (May 20) (In German) 6 ilustr.

Trade with Holland

The Buhova Bureau Voor Handelsinlichtingen, Oudebrugsleeg 16, Amsterdam — C., Netherlands, has issued its Buhova Trade Letter for 1959, which it will be glad to send to American firms interested in trade relations with Dutch firms. The "letter", a 46 page bulletin, contains the names of Dutch business organizations who have expressed interest in these matters. The letter lists manufacturers, import agencies, and firms who handle arrangements.

Outstanding Personalities of the Wire Industry

Tensolite Elects New President

Appointment of **Robert V. McLaughlin** as President and a Director of **Tensolite Insulated Wire Co., Inc.**, and its Pacific subsidiary in Los Angeles, has been announced by the Board of Directors.

* * *

Tensolite — a wholly owned subsidiary of **Carlisle Corporation,** Carlisle, Pa. — is a leading manufacturer of high temperature wire, cable, and cable assemblies. Its products are widely used in guided missiles, rockets, jet aircraft, radar and other electronic and electrical applications.

* * *

Tensolite's new President holds a BBA degree from St. John's U., a B, of Law from Fordham U., is a member of the N. Y. State Bar, and a CPA (New York State). He joined Tensolite as Secretary-Treasurer in 1955. Earlier he had been a Financial Analyst for General Foods Corp., and Asst. Treasurer of Burns & Roe.

Robert V. McLaughlin

Daystrom Opens Three Sales Offices

Daystrom-Weston Sales Division, **Daystrom, Inc.,** has announced the opening of two new branch offices and a new district sales office, effective July 1.

* * *

W. H. Steinkamp, vice-president of marketing, said the new offices, under direct division supervision, provide increased regional sales-engineering services for the sales organization, which now numbers 24 local field offices.

* * *

The new district sales office in Seattle, Wash., will service the Northwest market area, under **Ross K. Patterson,** manager.

* * *

Jess S. Smith has been appointed manager of a new branch office in New Orleans which is responsible for the New Orleans-Mobile area and is supported by the district sales office in Houston, Tex.

Glader—Years of Proven Performance
GLADER NAIL MACHINES
55 YEARS of experience meeting the exacting demands of nail making.
The machine with a record of steady dependable service.
Wm. GLADER MACHINE WORKS
210 N. RACINE AVENUE
CHICAGO 7, ILLINOIS
EXPORT DEPT. 122 EAST 42nd STREET • NEW YORK 17, N. Y.

Carl G. Ketel is now manager of a new Cedar Rapids branch office which will service eastern Iowa, Moline and Rock Island, Ill., under the Chicago district sales office.

Orin Haskell Heads Engineering Firm

The Mohawk Development Service, Inc., of Schenectady, New York, announces the elections of **Orin S. Haskell** as President and of **Richard Bliss** as Vice President of the company.

* * *

Mr. Haskell was formerly Manager of Marine Sales for the Atomic Power Equipment Department of the General Electric Company. Previous experience with General Electric covers 27 years, including 12 years in design engineering. Since World War II he has served as Manager of Furnace Sales for the Industrial Heating Department and Manager of Reactor Systems Engineering Unit for the Knolls Atomic Power Laboratory. Mr. Haskell is a graduate of U. S. Naval Academy, Annapolis, Maryland, Class of 1920.

* * *

Mr. Bliss was formerly Unit Leader of the Furnace Sales Section of the Industrial Heating Department of General Electric in Shelbyville, Indiana. His experience includes 16 years with General Electric, including assignments in design and application engineering activities as a specialist for wire processing equipment. Mr. Bliss is a graduate of Clarkson College of Technology, Class of 1943.

* * *

The Mohawk Development Service, Inc., offers a complete design, development and manufacturing service for product improvement and for process equipment development for magnet wire enameling equipment and the metal working industries. Allied with the group are more than 100 engineers, designers, draftsmen, manufacturing and laboratory specialists, experienced in the development and production of custom designed electrical, mechanical and electronic apparatus for industry and the government.

Appointed SKF Purchasing Director

Appointment of **Frank E. Whyte** to the newly created position of director of purchasing was announced by **Karl Kesselring,** vice president, production, **SKF Industries, Inc.**

* * *

In his new post, Mr. Whyte will direct and coordinate the ball and roller bearing manufacturer's purchasing and traffic department activities. A graduate of the University of Missouri, he has a master's degree from the Harvard University Graduate Business School.

Metal Carbides Elects New President

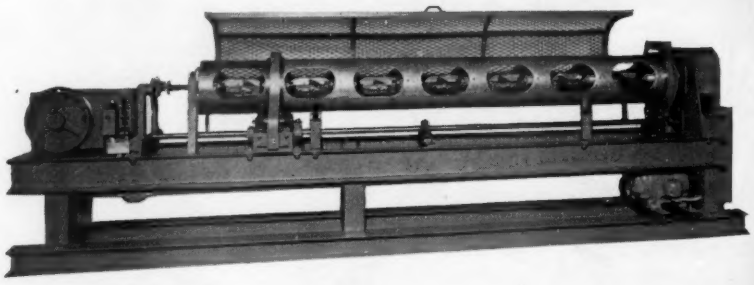
R. Thornton Beeghly has been elected president of **Metal Carbides Corporation,** Youngstown, Ohio, producer of Talide tungsten carbide metal for tools, dies,

SEVEN BAY
HIGH SPEED
STRANDER

MODEL 7 B 55

This precision, perfectly balanced machine features: rigid steel box structure-barrels of high strength ALCOA alloy — motor mounted below center of gravity — safe, positive drive — push button controls— carbide wire guides — interchangeable cradle assemblies — standard cradles taking 7" diam. X 4" Traverse Spools — 30 lengths of lay.

BARTELL FOR THE BEST



• CATERPILLAR CAPSTANS • SINGLE & MULTIPLE HEAD RESPOOLERS • WIRE STRANDERS
• TAKE-UP & PAY-OFF STANDS FOR PLATING EQUIPMENT

BARTELL MACHINE-TOOL CORP.
YACHT CLUB ROAD ROME, N. Y.
• DESIGNERS • MANUFACTURERS • ENGINEERS • CONSULTANTS

WE ALSO DESIGN AND BUILD SPECIAL EQUIPMENT TO MEET SPECIFIED REQUIREMENTS

blades, rolls and wear parts.

* * *

Mr. Beeghly succeeds his father, **L. A. Beeghly,** Youngstown industrialist who founded the company

R. Thornton Beeghly

and headed it since its organization in 1931. Thornton Beeghly joined Metal Carbides in 1934 and has been Vice President and General Manager since 1936.

* * *

Other officers elected were: **J. A. Ritz,** vice president, D. B. Peterson, treasurer, and **W. E. Scheetz,** secretary.

Dr. Toensing Joins Firth Sterling

Dr. C. H. Toensing, for eight years research and development engineer with the Lamp Metals & Components Department of **General Electric Company,** has been appointed manager, powder metals research at **Firth Sterling Inc.**

* * *

Dr. Toensing joins the Firth Sterling powder metallurgical research staff headed by **John C. Redmond,** director of research. Among Dr. Toensing's recent accomplishments has been preliminary laboratory development work on sintering tungsten, molybdenum, tantalum, and their alloys. Firth Sterling has recently announced the production and sale of forgeable tungsten and molybdenum.

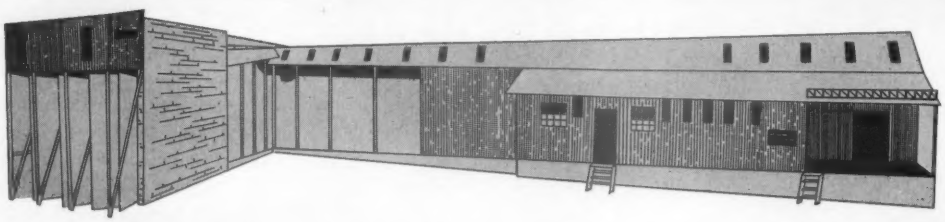
Roebling Elects New Production Executive

Election of **Edwin P. Boyer** as vice president of production of

Edwin P. Boyer

John A. Roebling's Sons Corp. a subsidiary of **The Colorado Fuel and Iron Corp.,** has been announced by **Alwin F. Franz,** president of C F & I.

* * *



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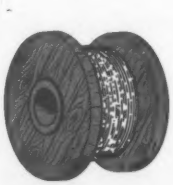

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Mr. Boyer joined Roebling in 1944 as a senior industrial engineer and served in a number of managerial and industrial planning positions before being made manufacturing manager of the cold rolled steel products division in 1954, a position he has held until his present advancement. He fills the post of **William C. Ridge** who was recently elected executive vice president.

* * *

A graduate of Mastbaum Vocational School, Mr. Boyer studied methods engineering and time study at Rutgers and Temple Universities respectively.

Risdon Appoints Sales Manager

Andrew C. E. Peasco, midwest sales representative of **The Risdon Manufacturing Co.,** since 1947, has been appointed industrial sales manager, it was announced by **Lewis A. Dibble,** president.

* * *

In his new position Mr. Peasco will coordinate sales of Risdon products — metal components, wire goods and chain — to industrial customers. His headquarters will be in Naugatuck, Conn.

* * *

He graduated from Yale in 1939 with a major in economics. Prior to joining Risdon he was associated with Connecticut General Life Insurance Co. and the Dictaphone Corp.

Chase Brass Promotes Three in Sales Dept.

Heading a series of Sales Dept. promotions effective July 20, **Robert H. Chittim,** formerly Product Manager for Tube and Fittings, has been advanced to a new post by Chase Brass & Copper Co., a subsidiary of Kennecott Copper Corp. He now handles special administrative assignments in Mill Sales at the firm's Waterbury, Conn. headquarters.

* * *

To replace him as Product Manager-Tube and Fittings at Waterbury, **Payne C. Barzler, Jr.** has been promoted from his previous position as District Manager of the Chase branch at Houston, Texas. He has been succeeded at Houston by **Homer D. Cebauer,** formerly a resident salesman for Chase at Tulsa, Okla.

Made Chicago Div. Sales Manager

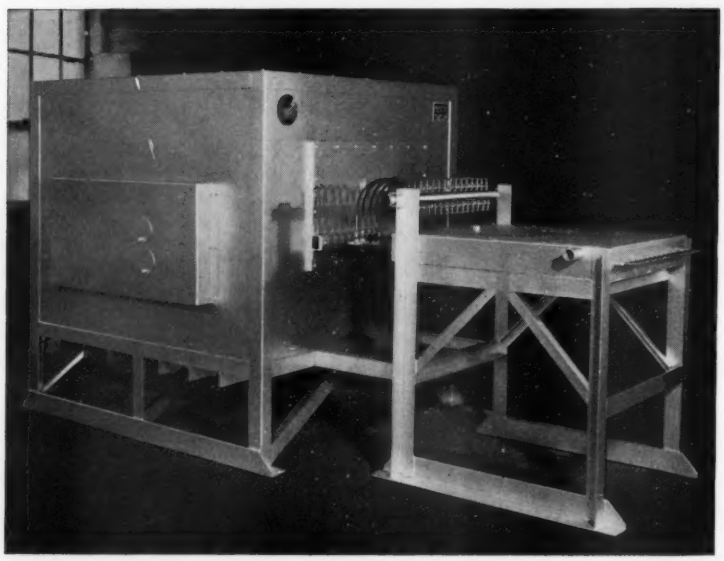
Edward C. Richardson has been appointed Chicago Division Sales Manager for **U. S. Industrial Chemicals Co.,** Division of National Distillers and Chemical Corporation. The announcement was made by **A. R. Ludlow, Jr.,** Vice President in Charge of Sales. Mr. Richardson replaces the former Chicago Sales Manager, **George H. Stanton,** who is now the Company's Director of Field Sales.

* * *

Mr. Richardson, who holds a Bachelor of Chemistry degree from Cornell University, has been with U.S.I. since 1940 and was Boston Division Sales Manager for the Company from 1950 until the time

HARPER STRAND ANNEALER

delivers bright stainless wire continuously at high speeds



Operating at temperatures from 2000°F. to 2200°F., this 30 tube Harper Electric Strand Annealing Furnace turns out Type 304SS wire bright and clean. Sizes from .02" to .0014" are passed through its 40" hot zone at rates up to 100 FPM per tube.

Providing close temperature control, Harper Strand Annealers maintain extremely dry reducing atmospheres to produce a truly bright finish. Designed for dependable, trouble-free performance over long periods, they permit wire speeds up to 150 FPM per tube.

Harper manufactures a full line of automatic conveyor, continuous tube, and bell type annealing furnaces for billets, bars, rods and wire. To solve your wire problem most profitably, call in a Harper engineer or write: Harper Electric Furnace Corporation, 42 River St., Buffalo 2, N.Y

HARPER
ELECTRIC FURNACES

of his new appointment. He is a Past President of the Chemical Club of New England and also is a member of the Society of the Plastics Industry and Society of Plastic Engineers.

A S & W Appointments

Three management appointments in Worcester District of U. S. Steel's **American Steel & Wire Division** have been announced by **Stephen B. Metcalfe,** district manager of operations.

* * *

Dana B. Carleton has been named works superintendent for New Haven (Conn.) Works succeeding **John J. Grimes, Jr.,** who was recently appointed general superintendent for New Haven and Trenton (N. J.) Works. Named to succeed Mr. Carleton as works superintendent at Trenton Works is **Albert K. Zeitell. James H. Merrill** has been appointed to Mr. Zeitell's former position as division superintendent, wire mill, for Worcester's South Works.

* * *

Mr. Carleton is a graduate of Worcester Polytechnic Institute, with a B. S. degree in electrical engineering. He came to Trenton Works in 1932 and successive promotions there advanced him to assistant general foreman, general foreman and department superintendent, until his appointment as works superintendent at Trenton in 1952.

* * *

Mr. Zeitell is a graduate of Pratt Institute (Brooklyn, N. Y.), where he received a B. S. degree in electrical engineering. He joined American Steel & Wire in 1937 and served successively as industrial engineer, foreman in the cable works and the wire mill, general foreman — finishing, department superintendent — finishing, and works supervisor of production planning. He was named department superintendent — round wire in 1947, and advanced to division superintendent of the wire mill in 1953.

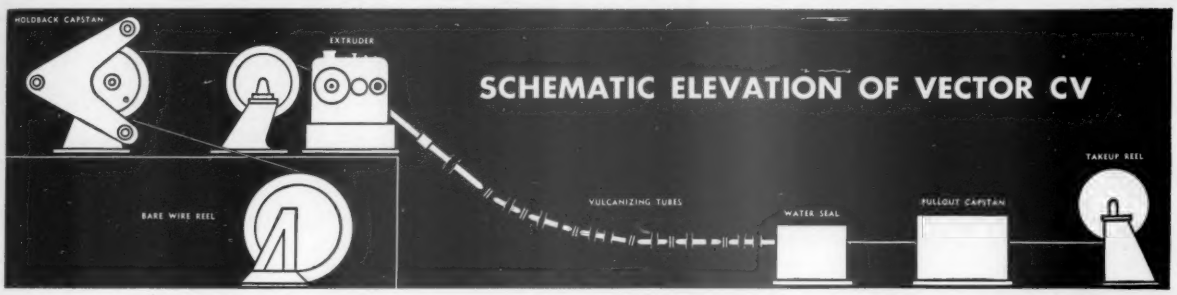
Left to Right: D. B. Carleton, A. K. Zeitell, J. H. Merrill

* * *

Mr. Merrill graduated from Rennselaer Polytechnic Institute in 1942 with a B.S. degree in metallurgical engineering. That same year he joined American Steel & Wire at South Works as a technical apprentice in the wire mill. After brief service as a junior laboratory metallurgist, he held various foreman positions in the round wire department. He was named a general foreman in that department in 1947, and was advanced to department superintendent in 1953.

Carpenter Steel Promotes Metallurgist

The Carpenter Steel Co., Reading, Pa., has appointed **Edward D.**



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- **ECONOMY**—Easily installed without extensive—and expensive—plant alterations.
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Hinkel, Jr. to the position of assistant sales metallurgist. In his new position he will be responsible for technical service to customers on engineering problems involving the selection of steels.

* * *

He joined Carpenter in 1950 as a member of the company's research and development group. In 1952 he joined the technical service group, with time out during 1954-56 for work at the Frankford Arsenal of the U. S. Army on ferrous metallurgy.

Fielder to Manage Loewy-Hydropress

McClure Kelley, president of **Baldwin-Lima-Hamilton Corporation,** Philadelphia, Pa., has announced the election of **Frederick A. Fielder** as vice president and general manager of its **Loewy-Hydropress Division,** New York.

* * *

General sales manager and assistant general manager of the division since 1955, Mr. Fielder succeeds the late **Erwin Loewy** who founded the companies that have become the Loewy-Hydropress Division, which is one of the nation's largest designers and builders of heavy presses, rolling mills and auxiliary machinery for steel and non-ferrous metals.

* * *

A graduate civil engineer of the University of Arizona and of the law college at George Washington University, he became affiliated with the organization in 1952.

Boston Sales Manager for U.S.I.

Jesse H. Hallowell has been named Boston Sales Division Manager for **U. S. Industrial Chemicals Co.,** Division of National Distillers and Chemical Corporation. The announcement was made by **Alden R. Ludlow, Jr.,** Vice President in Charge of Sales. Mr. Hallowell replaces **Edward C. Richardson,** who will become U.S.I. Manager of Chicago Sales.

* * *

Mr. Hallowell was working as a salesman out of the Company's Chicago Office at the time of his new appointment. Proir to this he had been located at the U.S.I. Tuscola, Illinois Technical Service Laboratory where he started his employment with the Company in 1953 He was graduated from Eastern Illinois State College in 1950.

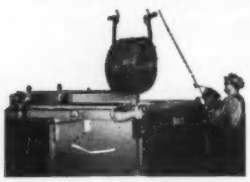
Dow Corning Advances Three

William W. Pedersen, manager of the **Dow Corning Corporation** Cleveland sales office, is being transferred to the main office, Midland, Michigan, it has been announced by **Dr. W. R. Collings,** President of Dow Corning. Mr. Pedersen becomes a full-time member of a new corporate planning committee reporting to the president.

* * *

This group, which includes **R. W. Caldwell** and **A. W. Rhodes,** will study and make recommendations regarding such corporate activities as the addition of new product lines and the expansion of existing ones, manufacturing, development, and marketing facilities, plant locations, and other matters related

TYPICAL — The Ajax installation at right treats 1000 lbs. of aluminum alloy wire an hour. It is also used for annealing brass and copper wire and for stress relieving cold headed C1008 ½" steel rods. (Lower left) 700 lb. charges of steel wire are brought to annealing temperature in less than 15 minutes, clean, scale-free and without decarburization.



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to the growth of the business. Dow Corning is the world's largest manufacturer of silicones.

* * *

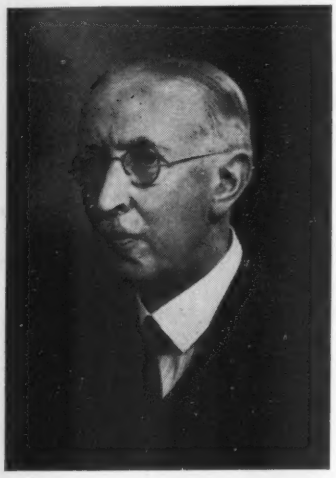
Max H. Leavenworth, now manager of the Southwestern branch in Dallas, will become manager of the Cleveland office, according to **O. D. Blessing,** Vice President-Sales Manager, and **Edwin Haire** of the Dallas office will succeed Leavenworth as manager.

Wilfred Moody

Wilfred Moody, eight-five, Managing Director of **The Lancashire Wire Co. Ltd.,** Manchester, England, until 1955, passed on in June.

* * *

He received his education at the Technical College in Huddersfield, Yorkshire, where he specialized in



Wilfred Moody

chemistry and engineering. He served as a Hydraulic Engineer in that city for some years and entered the steel and wire industry in 1906 as a technical supervisor. Mr. Moody was appointed a Director of The Lancashire Wire Company in 1914 and was made Managing Director in 1923. He was in active association with the company up to the time of his death.

* * *

Mr. Moody had been a member of The Wire Association for twenty-one years.

Heads R B & W Western Sales

James M. Bell has been named to the newly-created position of assistant vice president of sales in charge of the western division for **Russell, Burdsall & Ward Bolt and Nut Company,** according to John S. Davey, sales vice president of the 115-year old industrial fastener manufacturer, which operates plants in Port Chester; Coraopolis, Pa.; Rock Falls, Ill.; and Los Angeles.

* * *

Mr. Bell joined R B & W as a salesman in June, 1952 and became Pacific Coast sales manager in July of 1954. He will continue in Los Angeles, supervising a sales force covering California, Oregon, Washington, Idaho, Utah, Arizona, Nevada, New Mexico, western Texas, Alaska and Hawaii.

Appoints Two to Field Managerial Positions

The Carpenter Steel Company, Reading, Pa., has promoted two men in the Cleveland and Buffalo district offices.

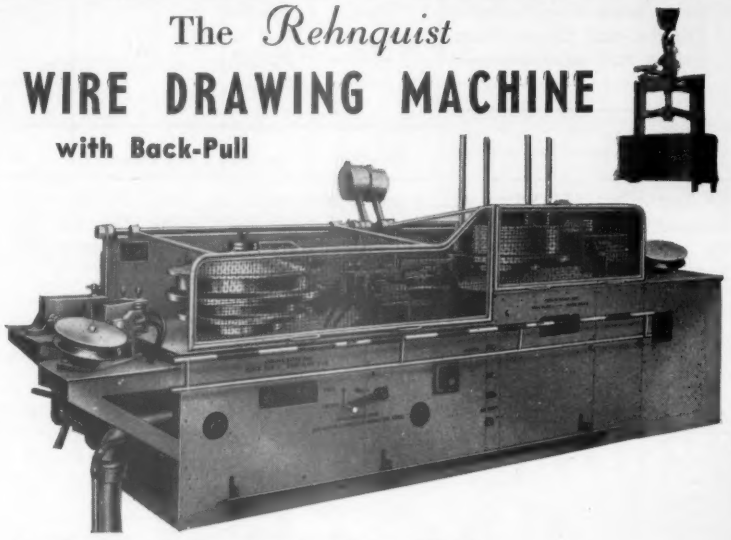
* * *

Charles H. Harton, formerly district manager in Buffalo becomes district manager in Cleveland, covering also the Toledo and Pittsburgh areas. **James H. Magee,** formerly assistant branch manager in the Cleveland territory now moves to Buffalo as branch manager.

The *Rehnquist*

WIRE DRAWING MACHINE

with Back-Pull



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All dies and blocks water cooled. Pneumatic controls stop the machine if reel trouble develops. Full safety features to highest standards built in. Construction is heavy for long service. Finishing block supplied in diameters required for your operations. Machine occupies floor space of 12′ by 9′ overall. Motor is 85 hp, 2-speed AC, 865/1730 rpm. 4-speed gear box gives 8 different speeds of from 108 to 1380 fpm.

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COPPER - Consumption of refined copper in the United States, April-May 1959, in short tons

	Wire mills 1/	Brass mills 2/	Chemical plants	Secondary copper smelters	Foundries and miscellaneous	Total
April:						
Cathodes	755	8,976	(3)	66	(3)	9,797
Wire bars	81,061	5,908	(3)	—	(3)	86,969
Ingots and ingot bars	1,436	10,846	(3)	118	(3)	12,400
Cakes and slabs	—	14,150	(3)	—	(3)	14,150
Billets	—	17,824	(3)	—	(3)	17,824
Other	86	—	(3)	42	(3)	128
Total	83,338	57,704	(4)	226	(4)	4/143,268
May:						
Cathodes	631	7,353	(3)	64	(3)	8,048
Wire bars	78,239	5,191	(3)	—	(3)	83,430
Ingots and ingot bars	1,404	10,774	(3)	160	(3)	12,338
Cakes and slabs	—	12,927	(3)	—	(3)	12,927
Billets	—	16,319	(3)	—	(3)	16,319
Other	72	—	(3)	34	(3)	106
Total	80,346	52,564	(4)	258	(4)	4/135,168

1/ Includes all wire mills with rod-rolling facilities. 2/ Includes all brass mills using copper in refinery shapes; some have rod-rolling facilities. 3/ Not available. 4/ Consumption by chemical plants, foundries, and miscellaneous plants not included. Estimate of 2,000 tons included in total.

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ALUMINUM INGOT AND MILL PRODUCTS AND MAGNESIUM MILL PRODUCTS: APRIL 1959

(Shipments and receipts are in thousands of pounds)

Item	Number of companies reporting shipments	April 1959			March 1959* net shipments	April 1958 net shipments
		Gross[1] shipments	Receipts[2]	Net[3] Shipments		
ALUMINUM PIG AND INGOT, TOTAL	91	262,859	133,958	128,901	114,208	64,662
ALUMINUM MILL PRODUCTS, TOTAL	157	319,458	25,904	293,554	271,642	211,483
Sheet and plate, non-heat-treatable	27	137,338	20,885	116,453	107,641	80,898
Sheet and plate, heat-treatable	4	17,639	...	17,639	22,180	15,748
Foil, including foil in lamination	13	(D)	(D)	22,349	20,938	15,874
Rolled, and continuous cast, rod and bar	6	14,178	3,677	10,501	10,526	6,077
Wire, bare, conductor and nonconductor	17	5,659	388	5,271	4,870	3,387
ACSR and aluminum cable, bare	12	(D)	(D)	16,561	13,168	15,706
Wire and cable, insulated or covered	14	(D)	(D)	3,636	4,052	3,084
Extruded shapes, alloys other than 2000 and 7000 series[5]	101	77,471	799	76,672	65,070	51,343
Extruded shapes, alloys in 2000 and 7000 series[5]	8	4,393	...	4,393	4,359	3,660
Drawn tube, alloys other than 2000 and 7000 series	12	(D)	(D)	8,275	7,810	6,115
Drawn tube, alloys in 2000 and 7000 series						
Welded tube, non-heat-treatable	7	(D)	(D)	4,135	4,037	2,822
Powder and paste:						
Atomized	3	1,073	...	1,073	973	600
Flaked	5	(D)	(D)	449	343	277
Paste	5	1,656	...	1,656	1,262	1,077
Forgings (including impact extrusions)	13	4,491	...	4,491	4,413	4,815
MAGNESIUM MILL PRODUCTS, TOTAL	10	(D)	(D)	2,089	1,717	1,479

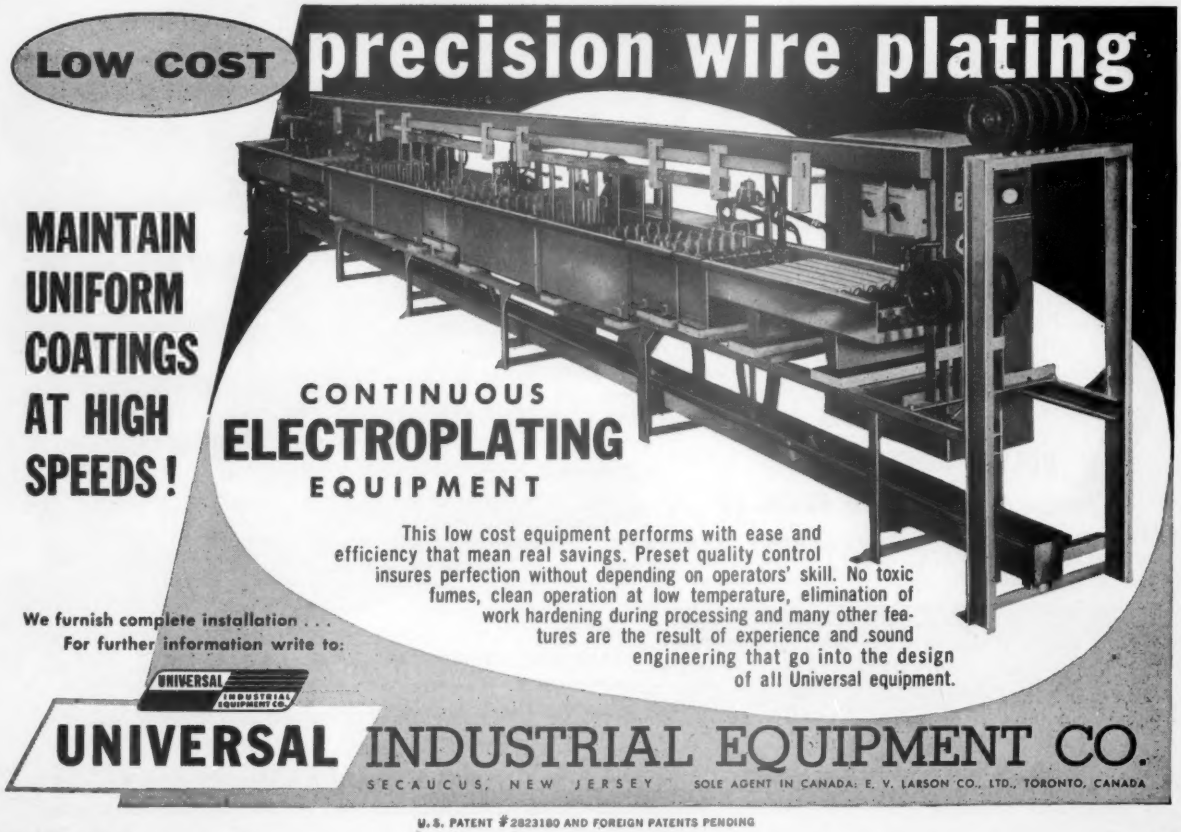
*Revised.

D Withheld to avoid disclosing figures of individual companies. These figures are included, however, in the appropriate total.

[1]Gross shipments of mill products represent total shipments by producers to customers, including other producers, and shipments by producers to their own fabricating departments which manufacture products beyond the level of mill shapes. Ingot gross shipments include shipments by importers.

[2]For mill products, represents receipts from domestic producers only. In addition to receipts from domestic producers, 71,000 pounds of mill shapes were received through imports. For ingot, receipts from imports are included.

[3]For mill products, derived by subtracting the sum of producer's domestic receipts of each mill shape from the industry's gross shipments of that shape. Ingot data derived by subtracting all receipts from shipments reported.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MAY – 1959
Month

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

Steel Products	Item	CURRENT MONTH 1959						YEAR TO DATE 1959 *					
		Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1958) Percent of Total Shipments	Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1958) Percent of Total Shipments
Ingots and Steel Castings	1A	16,749	12,858	3,014	32,621	0.4	0.5	67,176	59,000	10,335	136,511	0.4	0.5
Blooms, slabs, billets, sheet bars	1B	123,539	58,092	2,216	183,847	2.1	1.9	533,032	244,989	7,961	785,982	2.1	2.0
Tube rounds	1C	1,008	166	-	1,174	-	-	6,018	1,565	6	7,589	-	-
Skelp	2	12,206	-	-	12,206	0.1	0.2	29,964	-	-	29,964	0.1	0.2
Wire rods	3	122,364	3,137	1,318	126,819	1.5	1.6	564,896	15,091	5,188	585,175	1.5	1.6
Bars—Hot rolled (incl. light shapes)	14	681,825	203,271	5,112	890,208	10.2	8.9	2,951,415	867,133	21,337	3,839,885	10.1	8.9
Bars—Reinforcing	15	256,318	-	-	256,318	2.9	4.1	1,048,315	-	-	1,048,315	2.7	3.2
Bars—Cold finished	16	147,163	26,641	6,801	180,605	2.1	1.6	620,617	119,022	27,767	767,406	2.0	1.7
Tool steel	17	1,407	8,602	-	10,009	0.1	0.1	5,887	36,922	-	42,809	0.1	0.1
Wire—Drawn	23	333,253	4,971	3,729	341,953	3.9	4.3	1,350,503	21,057	15,315	1,386,875	3.6	3.9
Wire—Nails & staples	24	50,600	-	2	50,602	0.6	0.9	200,527	-	7	200,534	0.5	0.8
Wire—Barbed & twisted	25	7,000	-	-	7,000	0.1	0.2	30,207	-	-	30,207	0.1	0.1
Wire—Woven wire fence	26	21,019	-	-	21,019	0.2	0.4	89,878	-	-	89,878	0.2	0.4
Wire—Bale ties & baling wire	27	8,863	-	-	8,863	0.1	0.3	33,950	-	-	33,950	0.1	0.1
Total Wire & Wire Products		420,735	4,971	3,731	429,437	4.9	6.1	1,705,065	21,057	15,322	1,741,444	4.5	5.3
Sheets—Hot rolled	31	916,216	29,457	1,667	947,340	10.8	9.4	4,181,745	143,359	7,294	4,332,398	11.3	9.5
Sheets—Cold rolled	32	1,471,259	6,957	17,359	1,495,575	17.1	14.2	7,142,230	28,654	69,955	7,240,839	18.9	15.6
Sheets—Galvanized	33	316,326	733	-	317,059	3.6	5.0	1,525,617	733	-	1,526,350	4.0	4.3
Sheets—All other coated	34	29,270	-	-	29,270	0.3	0.2	137,239	-	-	137,239	0.4	0.3
Electrical sheets & strip	35	5,597	68,323	-	73,920	0.9	0.7	22,268	302,147	-	324,415	0.9	0.8
Strip—Hot rolled	36	156,566	3,346	1,018	160,930	1.8	1.5	687,389	12,228	6,059	705,676	1.8	1.6
Strip—Cold rolled	37	121,249	2,142	26,170	149,561	1.7	1.4	536,516	8,836	109,271	654,623	1.7	1.6
Total Sheets and Strip		3,016,483	110,958	46,214	3,173,655	36.2	32.4	14,233,004	495,957	192,579	14,921,540	39.0	33.7
Total Shipments (1959)		8,099,208	580,273	74,638	8,754,119	100.0	xxx	35,445,301	2,468,098	305,741	38,219,140	100.0	xxx
Total — Prior Year (1958)		4,383,961	229,959	35,579	4,649,499	xxx	100.0	21,474,883	1,295,923	181,494	22,952,300	xxx	100.0

* Revised

63059

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... indicate a world-wide reputation. Hanson & Edwards have supplied High Speed Tubular Stranding Machines to many of the most important Wire Rope and Cable factories throughout the world. These machines have rotors which run in large SPLIT ROLLER BEARINGS, not on support rollers, giving higher speeds, smoother running and lower maintenance costs

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P2035

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50c for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,893,091, SAFETY-PINS, patented July 7, 1959 by Harold Mitchell, Birmingham, England, assignor to George Goodman Limited, Birmingham, England, a British company.

A wire safety pin is disclosed in which a metal sheath is provided for sliding movement over or away from the prong engaging cap of the pin.

* * *

No. 2,893,195, COIL WINDING MACHINE, patented July 7, 1959 by Arno Greiner, Irvington, N. J., assignor to Uwimco, Inc., Springfield, N. J., a corporation of New Jersey.

Included in this wire coil winder is a hollow spindle and a mandrel movable through the spindle actuated by a walking beam the fulcrum of which may be shifted and thereby varying the rate of advancement of the mandrel from the spindle for thereby varying the number of coils of filament applied to the mandrel per unit length of advancement of the mandrel. Twelve claims.

* * *

No. 2,893,200, METHOD OF FORMING AN ORNAMENTAL CHAIN, patented July 7, 1959 by Adolf Jaeger, Cranston, R. I., assignor to Federal Chain Company, a corporation of Rhode Island.

A method is disclosed for forming a chain of U-shaped wire portions locked together.

No. 2,893,544, APPARATUS FOR DRAWING WIRE, patented July 7, 1959 by Kenneth F. Russell, Claremont, California.

The wire drawing apparatus comprises a unitary wire-receiving capstan having a number of cylindrical steps of different diameters, each being provided with a number of separate circumferential tracks, each track being adapted to receive only a single strand of wire, and a track-separating device between adjacent tracks on each step.

* * *

No. 2,893,654, MULTIPLE COILER, patented July 7, 1959 by Thomas E. Lewis, Jr., Trumbull, Conn., assignor to The Coulter & McKenzie Machine Co., Inc., Bridgeport, Conn., a corporation of Connecticut.

This wire coiler includes a common frame having a bank of feeding and coiling stations tandemly mounted thereon with wire containers where a cast is applied to the wire to cause it to form coils in the containers. Coiled wire may be removed from a container without interrupting the operation of the other stations.

* * *

No. 2,893,657, DELIVERING WIRE OR LIKE FLEXIBLE ELEMENT FROM A COIL, patented July 7, 1959 by Pieter A. van de Bilt, Maartensdijk, Netherlands, assignor by mesne assignments, to Package Sealing Co. (Export) Limited, Ealing, London, England, a British company.

Mechanism for delivering wire from a coil to an associated machine is disclosed comprising a shaft rotated intermittently corresponding to the demand of the machine for wire, a drum for the wire freely mounted on the shaft, a shuttle arm mounted on the shaft and driven positively thereby around the drum to pick up a predetermined length of wire therefrom, and a spring device operatively connecting the drum and arm to the shaft and adapted to rotate the drum in a direction opposite to the rotation of the arm when the shuttle delivers a length of wire less than the demand of the machine.

* * *

No. 2,893,664, SEAM FOR WIRE FABRIC AND METHOD OF MAKING SAME, patented July 7, 1959 by John P. Gerhauser, Appleton, Wis., assignor, by mesne assignments, to Appleton Wire

SEE THE DIFFERENCE YOURSELF...
BETWEEN JUST ANY SPOOL AND
Superior MPS
NO-CREV SPOOLS
No-Crev Spools eliminate the conventional crevice at the inner junction of spool head and barrel. No more production slow-ups due to fine wires getting caught in such a crevice. You can now have continuous trouble-free high speed winding.
We invite your inquiries — let us tell you more about No-Crev Spools. Write us today.
MPS
NO-CREV SPOOLS
give you brute strength with dimensional precision, concentricity, and balance. Another patented MPS development engineered to help you!
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#108

Works Corp., Appleton, Wis., a corporation of Wisconsin.

The method is adapted for producing a seam in a Fourdrinier wire formed of copper content threads coated with tin. Some claims are directed to the method and others to the seam itself.

* * *

No. 2,894,617, APPARATUS FOR FEEDING A PRESELECTED LENGTH OF WIRE, patented July 14, 1959 by Harold K. Embree, Hamilton, Ontario, Canada, assignor to Ovalstrapping Inc., Hoquiam, Wash., a corporation of Washington.

Tapered and grooved pinch rolls are provided, rotatable in opposite directions but at the same speed, with shielding devices mounted on the casing apparatus and being adjustable longitudinally of the line of tangential contact of the pair of rolls to limit the length of the line of contact which is exposed for insertion of a wire between the rolls.

* * *

No. 2,894,699, TOROIDAL COIL WINDING MACHINE, patented July 14, 1959 by John Onisko, Jr., China Lake, California.

The method comprises forming a circular supply of wire passing through the aperture of a closed loop member and rotating the supply in a certain direction until a desired annular amount of the supply is formed, linking the free end of the flexible member to the closed loop member and rotating the supply in this certain direction, and effecting a running kink in a portion of the flexible member extending between the supply and the loop member during the period the flexible member is being payed off from the annular supply, and locking the kink to the supply during a non-pay-off portion of its revolution.

* * *

No. 2,894,850, METHOD OF GALVANIZING FERROUS METAL STRIP, patented July 14, 1959 by Joseph L. Greene, Royal Oak, and James C. Holzwarth, Birmingham, Mich., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware.

More specifically the seven claims cover a process for galvanizing a portion only of the metal strip.

* * *

No. 2,895,210, METHOD OF PACKAGING WIRE, patented July 21, 1959 by Eber J. Hubbard, Fort Wayne, Ind., assignor, by mesne assignments, to The American Pulley Company, Philadelphia, Pa., a corporation of Pennsylvania.

The wire is looped in a generally rectangular box in figure 8 loops.

No. 2,895,543, CASING FOR VENTILATING CUSHIONS, patented July 21, 1959 by Samuel P. Crane, Great Neck, and Stephen D. Kent, Newburgh, N. Y.

Enclosed in the cushion covering is an inner coiled wire unit disposed in a foraminous partial casing of two spaced apart foraminous sheets.

* * *

No. 2,896,214, WIRE STAPLE HANDLING APPARATUS, patented July 28, 1959 by Theodore M. Wright, Camden, N. J.

This apparatus is of the class where the staple is initially formed of wire into a reversely-bent staple having a loop portion and a pair of legs.

* * *

No. 2,896,286, LOCKABLE SAFETY PIN, patented July 28, 1959 by Peter Welschhof, Rietheim, Kreis Villingen, Germany, assignor of one-half to Paul E. Tobeler, doing business under the name of Trans-Oceanic, Los Angeles, California.

The wire safety pin has a slidable cap which contains spring means to lock the prong-pointed end of the pin in a locked position.

* * *

No. 2,896,383, APPARATUS FOR COVERING WIRE GARMENT HANGERS, patended July 28, 1959 by Ben J. Aronson, Skokie, Ill., assignor, by mesne assignments, to Aronson Hanger Covers, Incorporated, Chicago, Ill., a corporation of Illinois.

There are forty-five claims in this patent in which each cycle of machine operation produces a covering on the wire hanger.

* * *

No. 2,896,689, APPARATUS FOR FORMING A HELICAL WIRE COIL ON AN AXIALLY TRAVELING ROTATING MANDREL AND HAVING FIXED GUIDE GROOVES TO IRON SAID COIL ONTO SAID MANDREL, patented July 28, 1959 by Richard A. Arms, Menlo Park, California, assignor to Hewlett-Packard

With **COOK'S** *improved, high speed*
HOT-DIP TANK TINNER

You can enjoy production up to
20,000 FEET A MINUTE!*

Yes, here is America's most advanced-design tinning installation. Fully complete because it includes a supply stand, flux pot with dip rods and wipes, tinning tank with burner and automatic temperature control units, water cooling tank with recirculating pump and high-speed take-up that maintains constant linear speed. Remember, every part of this machine can be built to suit your own particular individual needs.

* Using 20 lines of fine wire

Check these
FEATURES

- Very flexible in its design
- Gives wire perfect uniformity
- Uses improved wiping method and dip rod construction
- Cannot produce rough wire
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- Takes 12 to 20 lines or spools
- Up to 1000 ft. per minute speed
- Low initial investment

COOK Manufacturing COMPANY
50 EAST 25th ST., PATERSON 4, N. J. — ARmory 4-6380
Wire and cable processing and fabricating machines

Company, Palo Alto, Calif., a corporation of California.

A driven mandrel is associated with a winding head having a first cylindrical presser rotatably mounted in the head and disposed adjacent the mandrel to press against the wire coil, and a second cylindrical presser yieldably and rotatably mounted in the head and serving to yieldably bear against the coil. Ten claims.

No. 2,896,690, INERTIA-TYPE OVERWIND DEVICE FOR A FILAMENT COILING MACHINE, patented July 28, 1959 by Harold H. Meisinger, Roseland, N. J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania.

A fractional turn of the filament is made by rotation of a first rotating winder after a second winder has ceased its winding operation. Ten claims.

* * *

No. 2,896,815, CARRIER TRAY FOR CONTAINERS, patented July 28, 1959 by Mildred F. Longan, Baldwin Park, Calif., assignor to Renfro-Franklin Company, Baldwin Park, Calif., a corporation of California.

The tray is constructed wholly of bent wires to form a number of compartments to receive and retain containers.

* * *

No. 2,896,868, METHOD OF AND APPARATUS FOR WINDING COILS IN PLACE, patented July 28, 1959 by Henry T. Machlanski, Westwood, N. J., assignor to Kearfott Company, Inc., Little Falls, N. J., a corporation of New York.

Mechanism for winding a coil in place in a slotted magnetizable core structure, from a supply spool or wire is disclosed, with frictional rubbing contact of the wire against the core structure is avoided. Ten claims.

* * *

No. 2,896,869, WIRE TINNING SYSTEMS, patented July 28, 1959 by Otto Haugwitz, La Celle Saint Cloud, France, assignor to Ste Anonyme Geoffrey-Delore, Paris, France, a French company.

The system includes two wire-receiving sheaves, with a pulley arrangement to reverse the direction of travel of the wire in passing from the first sheave to the second sheave, whereby the first sheave is driven from the second sheave, as the second sheave is driven by the wire moving in response to the take-up reel.

Scott Testers Offers New Payment Program

Scott Testers, Inc., a leading maker of physical testing equipment for measuring tensile strength of industrial substances, has announced a merchandising program that will make its equipment available on five-year instalment purchase or rental purchase plans.

* * *

Details of the program were developed with C.I.T. Corporation, the nation's largest industrial financing firm, said President David C. Scott, Jr.

* * *

Scott equipment, ranging in price from $1,000 to $15,000, is widely used for evaluating tensile strength of textiles, wire, rubber, plastics, and other products. The Scott company was formed in 1899, and its products, almost universally accepted as standard for various industries, are now in use in 62 foreign countries.

* * *

Details are available upon request. Write Scott Testing, Inc., 56 Blackstone St., Providence, R. I.

Spring Maker Using Heavy Coils

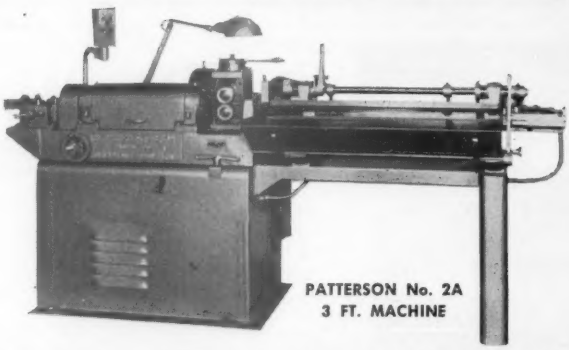
Your new automobile may have its steel roof supported by high-strength, heavy-gage spring wire. This detail was recently revealed at the **Young Spring and Wire Company's** Vernon, California, wire forming plant.

* * *

According to Young's manager. **William Grace,** there is nothing new about the Headlining Wire so used and his primary interest is in developing better methods and equipment to form the many spring wire shapes his plant turns out for

GEO. C. PATTERSON
HI-SPEED
AUTOMATIC WIRE STRAIGHTENING & CUT-OFF MACHINES

ELECTRICALLY OPERATED
with VARIABLE SPEED DRIVE



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3 FT. MACHINE

We are proud to present this machine & 35 additional models to the mills and fabricators of wire, for we honestly believe they are top value in their field today. We have spared no expense to give you a precision machine tool that will give years of uninterrupted service. All iron castings are close grained Meehanite iron; cut-off and opener levers are high grade steel castings; all guides are hardened tool steel; electrical equipment is wired ready to run.

- MINIMUM COST
- MAXIMUM PRODUCTION
- ACCURATE LENGTHS
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The GEO. C. PATTERSON Machine Company

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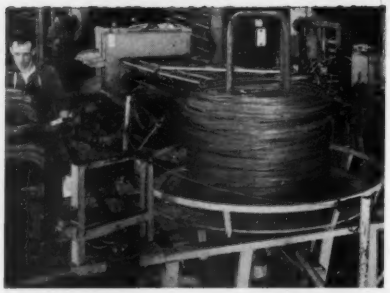
the auto industry. One of the latest improvements in his production line in the switch to one-ton and two-ton coils in place of 200-pound to 300-pound coils.

* * *

The change-over to two-ton coils has been worked out with the management at **Bethlehem Pacific's** Los Angeles Wire Mill. Special reels designed by Young's engineers are spotted at the ends of Bethlehem Pacific's wire drawing lines and when the desired weight of wire has been wound on the reel, it is ready to be moved to the Young plant for forming. By thus eliminating any change of reels, time is saved at the Wire Mill. More important however, is the elimination of six shut-downs of wire forming machines at the Young plant. This represents a savings of approximately 45 minutes in operating time per machine.

* * *

The change to heavier coils at the Young Spring and Wire Company's facility has been made for



Two-ton reel of 8 gage wire for making Headlining Wire Springs. * * * * *

machines which produce the 9- and 10-gage, Zig-Zag spring wires for auto seats and the 6- and 8-gage, high carbon Headlining Wire used as ribs in the car roofs. Most of the output in this plant is for the auto assembly plants in Southern California. Although the plant has been operating at its present location for over 20 years, the company has been in the wire forming business for over 50 years.

Installs Communications Network

A new, 900-mile, automatic communications system now enables **Dow Corning Corporation,** leading manufacturer of silicone products, to cut in half the time needed to process sales and shipping orders.

* * *

Leased from the Long Lines Department of the American Telephone and Telegraph Company, the private line teletypewriter system links company headquarters at Midland, Michigan, to sales offices at New York, Boston, and Silver Spring, Maryland, and to the company's eastern warehouse at Jersey City, New Jersey.

* * *

Among silicone products produced by Dow Corning are water repellents, fluids, lubricants, defoamers, release agents, protective coatings, electrical insulation, and Silastic, the Dow Corning silicone rubber.

TO SELL—ADVERTISE IN
WIRE AND WIRE PRODUCTS

Sjogren SPOOLER

This machine is especially designed for wire mill use and incorporates many outstanding features adapted to present day high speed production.

SPEED — When placed directly behind wire drawing machine the Sjogren Spooler is capable of spooling at 1800 fpm.

CAPACITY — 100 pound maximum.

TRAVERSE — Hydraulic traverse is infinitely adjustable from zero to 5/8" per rpm of spool.

LOADING — Loading of spool is air-actuated.

TENSION — Louis-Allis eddy current clutch type motor with potentiometer for variable tension.

STARTING — Forced acceleration circuit prevents slack wire during wire drawing machine acceleration.

BRAKING — Goodyear airplane disc type brakes.

USED BY WIRE MEN
WHO WANT THE BEST!

Sjogren TOOL & MACHINE CO., INC.

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WIRE PULLERS • WEDGE GRIPS • JAWS FOR ALL MAKES OF PULLERS AND TESTING MACHINES • GAGE ROLLERS • SWAGING HAMMERS • POINTING DIES • WIRE SPOOLERS

Modern Pickling and Yellow Pickling Plants

(Continued from page 1089)

By reason of the greater reliability, armoured construction is recommended. Gas pipings are made of Vinidur. For strong mechanical stresses, however, either Polyester material Bendurplast with glass fibre armouring or rubber-lined steel plate is used. Vinidur fans have stood the test for smaller capacities. Fans for higher capacities are made of rubber-lined steel plate. The usual pumps are centrifugal, operating horizontally or vertically. The type and the corrosion proof material must be determined with due regard to the chemical, thermal and mechanical stresses.

* * *

Special care must be taken with the lining of the plant building. Floors, channels, foundations and pits must be acid proof lined. Generally, the tanks are located in acid proof lined pits. Collecting channels feed the rinse and spray waters from the pit to the neutralization plant. The wall of the plant building is provided with an acid proof lining up to a certain height, so that the spray cannot attack the brickwork. Structural members of brickwork and steel and construction materials which are attacked by weakly agressive vapours are protected with acid proof paint coat of varnish, based on chlorine caoutchouc, synthetic material, and bitumen.

Summary

In designing up-to-date pickling plants, many processing and engineering problems must be considered. The mechanical equipment must guarantee a reliable flow of the material combined with low labour expense. The composition of the pickling bath must be permanently controlled and, if possible, a uniform concentration maintained by extraction of the salt formed during pickling. The temperature of the pickling bath must be kept constant by heating. Noxious gases escaping from the bath must be drawn off and destropped. All parts of the plant subject to contact by the acid must be very carefully constructed of corrosion proof material. Only a specialist with long experience who has always endeavored to improve the efficiency of pickling plants and to reduce at the same time the costs of operation, will be able in each individual case to decide which measures are necessary or practical. It is, therefore, desirable to ask for an expert's advice during the initial planning stages.

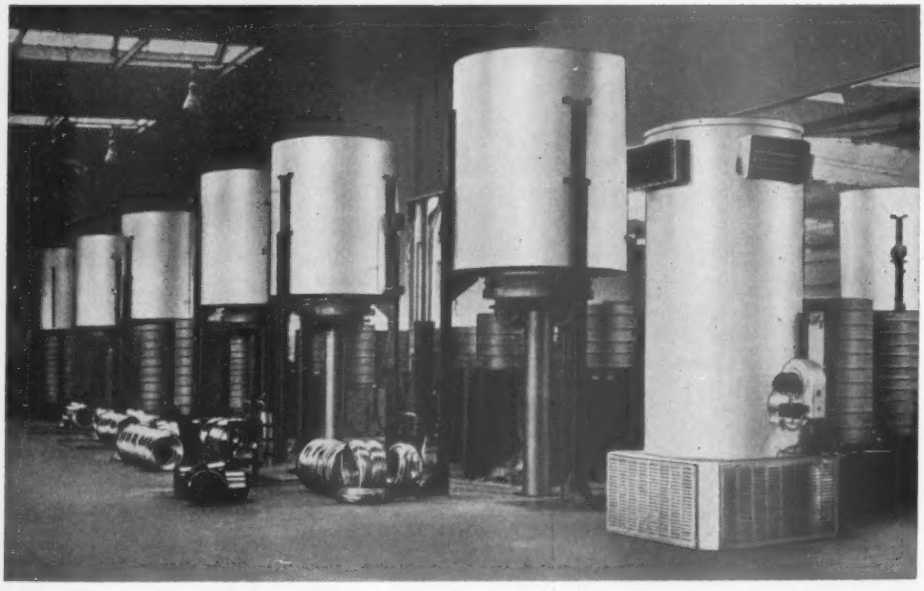
Alcoa And Kaiser Join Penelec To Build 460 KV Line

Two fabricators of conductors have joined three previously announced suppliers and Pennsylvania Electric Company in building a 460 KV experimental line.

* * *

They are the **Kaiser Aluminum and Chemical Corp.** and the **Aluminum Corporation of America,** who jointly will supply approxi-

THE LAST WORD IN MODERN EFFICIENT DESIGN!



SEVERAL VACUUM BRIGHT ANNEALING UNITS WHICH WE HAVE INSTALLED IN ONE OF THE MOST PROMINENT CABLE WORKS IN GERMANY

(German and Foreign Patents)

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Willowdale; Ont., Canada

OFENBAU **FRITZ** G. m. b. H. & Co. K. G. **HAGEN,** (W.-GERMANY)

mately 728,000 pounds of aluminum transmission cable. Included will be 1.5 line miles of 2.32 inch diameter single conductor; 3.7 line miles of twin bundle 1.4 inch diameter expanded core ACSR conductor; 3.7 line miles of twin bundle 1.6 inch diameter expanded ACSR and 3.7 line miles of twin bundle 1.75 inch expanded ACSR.

* * *

In the 12.6 miles from Saxton, Bedford County, to Claysburg, Blair County, the line will cross two rugged mountain ranges and pass through a narrow valley. This provides geographical and meteorological conditions representive of the entire Penelec system and will permit testing of equipment under conditions imposed by snow, sleet, wind and severe lightning.

AS&W Producing Largest Strand for Towerguying

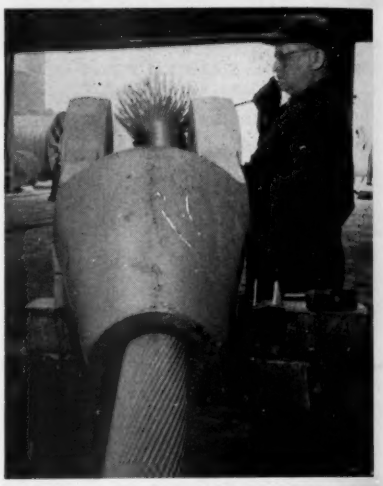
Trenton Works of U. S. Steel's American Steel & Wire Division is currently producing some 427,812 feet (80 miles) of high strength galvanized steel wire strand which will be literally hung in the clouds. The strand will be used to prevent possible aerial acrobatics of 26 sky-piercing radio transmitting towers the U. S. Navy is building in Maine.

* * *

These wire strands will "guy" or stabilize 12 towers that will rise 800 feet in the air; 12 that will soar up to 875 feet, and 2 that will be a heaven-scraping 980 feet tall. Arranged in two groups of thirteen each, the antenna towers will be a vital part of the most powerful radio transmitter in America.

* * *

To support these arrays of steel



Steel Strand Tower Guy Wire. Socket weighs 448 pounds and strand will be 1271 feet long.

pylons, American Steel & Wire is turning out 624 strand assemblies weighing 1800 tons. These range from 1″ to 3⅛″ in diameter, and from 281 feet to 1271 feet in length. A spider web-like network of guying strands will criss-cross between the towers in each of the two groups.

* * *

An interesting sidelight in connection with this project lies in American Steel & Wire's use of an IBM-650 computer to make necessary engineering calculations.

Welding Society To Meet In September

The American Welding Society fall meeting will be held in the Sheraton-Cadillac Hotel, Detroit, September 28 through October 1, 1959. Sixteen sessions will be held and a total of 48 technical papers will be presented. AWS headquarters are at 33 W. 39th St., New York 18, N. Y.

CALL US TODAY!

This is a strong, sturdy, "work horse" piece of equipment built to stand up for years under hard usage. It is adjustable and will handle any reel from 16″ to 30″ flange diameter and any traverse up to 11″. Can be equipped with any size arbor you want. Tension arm can be furnished with counter-weight for fine wire, or hydraulic shock snubber for heavy wire. Brake is fully releasing; drive pins are adjustable.

SPECIFICATIONS:

- Drive pins ⅜″ diameter (2 furnished).
- Drive pin location adjustable 4″ to 8″ center to center.
- Brake drum 8¼″ diameter x 2½″ wide.
- Standard arbor 1¼ or 1½ inches.
- 3″ and 5″ arbor adapters can be furnished.
- Bronze bearings with wick type oilers.
- Floor space at base 24″ x 24″. Overall floor space 29″ x 48″.
- Will accommodate reels having a maximum dimension over flanges of 14″.

ACROMETAL PRODUCTS, INC.
616 5th Street North, Minneapolis 1, Minn.

Bethlehem's Induction Heated Stress-Relieved Strand

(Continued from page 1091)

ing a production run. Each division on the chart represents 5°F.

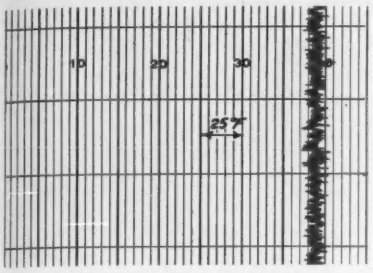


Fig. 3—Typical temperature record taken during a stress-relieving run.

Following the pyrometer and several guide rolls is a water quench and air blast, Figure 4.

Fig. 4—The water quench and air blast equipment.

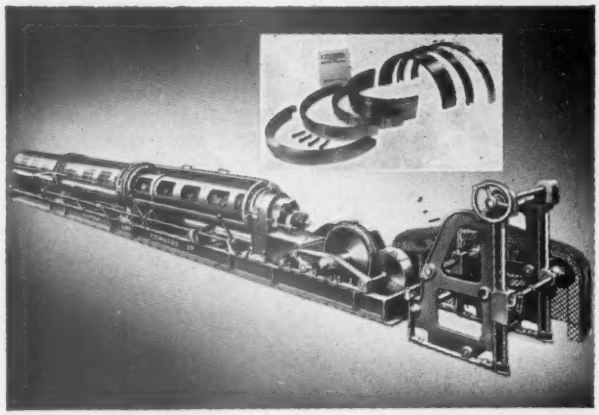
The amount and pressure of the water is controlled in order to reduce the strand temperature and still retain sufficient heat to produce a dry strand for reeling. Residual heat in the strand and the air blast assures a dry clean strand reaching the take-up reel.

* * *

Located on the traversing mechanism of the reel strand is a hydraulic shear for cutting the strand and a segmented rubber wheel drive mechanism for developing slack for the reel change operation. The take-up reel is designed to provide a constant predetermined strand tension as the reel builds up from empty to full.

HANSON & EDWARDS LTD.

ROLLER BEARING TYPE
HIGH SPEED TUBULAR
STRANDING MACHINES



THESE MACHINES HAVE ROTORS THAT RUN IN LARGE **SPLIT ROLLER BEARINGS,** SHOWN ABOVE — NOT ON SUPPORT ROLLERS — GIVING HIGHER SPEEDS, SMOOTHER RUNNING, AND LOWER MAINTENANCE COSTS.

MADE FOR REEL SIZES FROM 5" x 2½" TO 24" x 12".

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Continuous Tension Control
For Precision-Quality

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LATEST
AUTOMATED MULTI-SPINDLE
ROBERT J. EMORY SPOOLER

MODEL 400 B Two to Ten Heads Integral Payoff Non-removable arbors 3000 RPM Speed Automatic Stops

ADVANCED DESIGN • HIGHEST PRODUCTION • ACCURATE WINDING • WIDEST RANGE • FULLY ADJUSTABLE • ONE MAN OPERATION • PRODUCTION PROVEN

DETAILED FEATURES

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2. Individual Drives
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4. Wire Range .005"-.125"
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HI-SPEED REGISTERED
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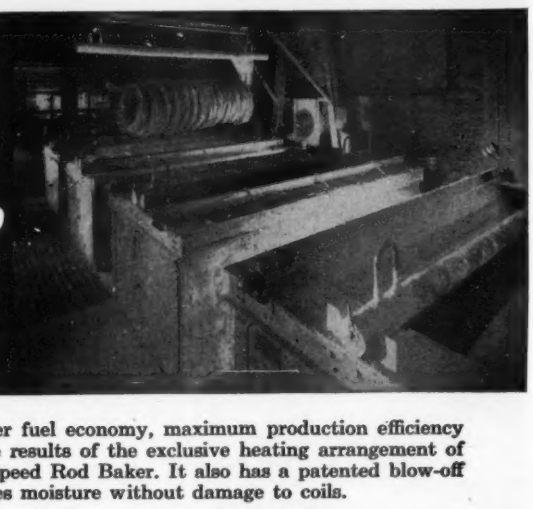

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This constant tension plus the guide rolls maintains the strand in the center of the induction coil. Figure 5 shows the reel strand

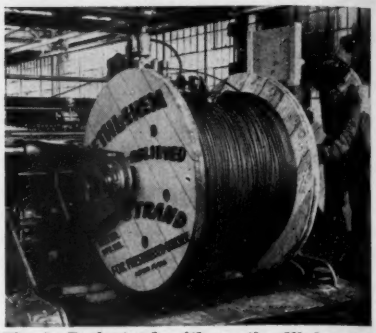

Fig. 5—Reel stand with partly filled reel of strand.

with a partially filled reel of strand in place.

* * *

The induction coil is employed only at operating speeds. Accuracy of measurement of the strand temperature at slow speeds was not considered practical. Thus in starting and stopping, some procedure had to be devised to assure that every foot of strand would be stress-relieved at the proper predetermined temperature. This is accomplished by the use of a looping tower.

* * *

The remarkable effectiveness of induction heating in the production of stress-relieved strand is illustrated by the typical stress-strain curves for 3/8" strand shown in Figure 6. Notice that the yield-

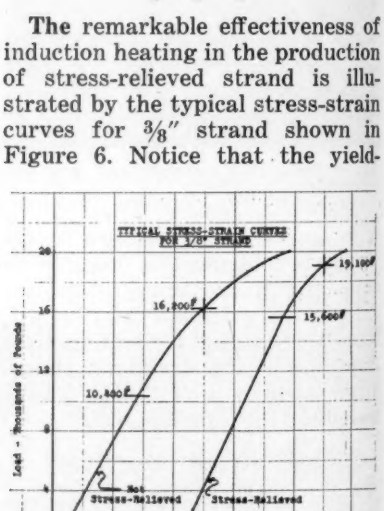

Fig. 6—Typical stress-strain curves for 3/8-inch strand before and after stress-relieving.

strength load at 1% extension (0.010 inches per inch) has been increased from 16,200 pounds to 19,100 pounds. Also, the straight

portion of the stress-strain curve has been extended from 10,400 pounds to 15,600 pounds, considerably above the specified working load of 14,000 pounds.

* * *

In summary, the production of stress-relieved strand by induction heating has resulted in a product having excellent properties. The surface of the strand is clean without foreign metal on the wire surfaces or entrapped between the wires. Reproducible and uniform mechanical characteristics between different reels of strand are achieved through the precise and close temperature control made possible by induction heating.

* * *

Bethlehem has applied for a patent on this development.

Aluminized Strand Service Test Results

(Continued from page 1101*)*

of forming a transparent film of aluminum oxide on its surface which controls its behavior in corrosive atmospheres. This oxide film forms almost immediately, when the wire emerges from the molten aluminum bath during manufacture, and is exposed to the atmosphere. At any subsequent freshly exposed surface, due to possible rubbing or abrasive action, the films reform almost immediately. Thus, the protection afforded by this film is continuous.

* * *

Aluminum oxide films hold a predominant advantage over zinc oxide films on galvanized products in that they adhere very tenaciously to the metal and do not weather away in most atmospheric conditions. Zinc oxides, on the other hand, are soft and porous and do weather away quite rapidly.

* * *

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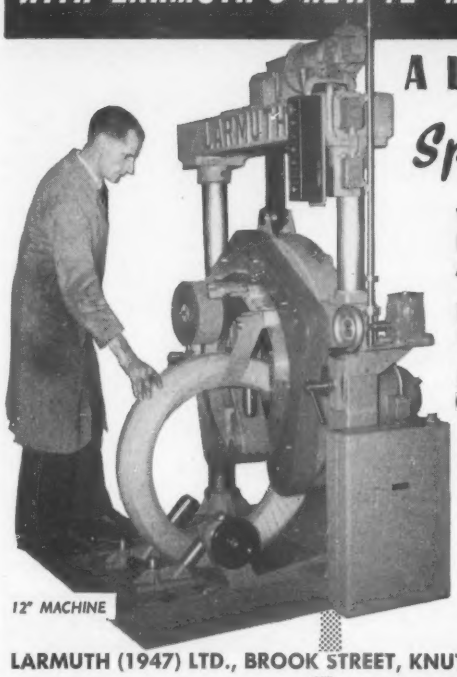

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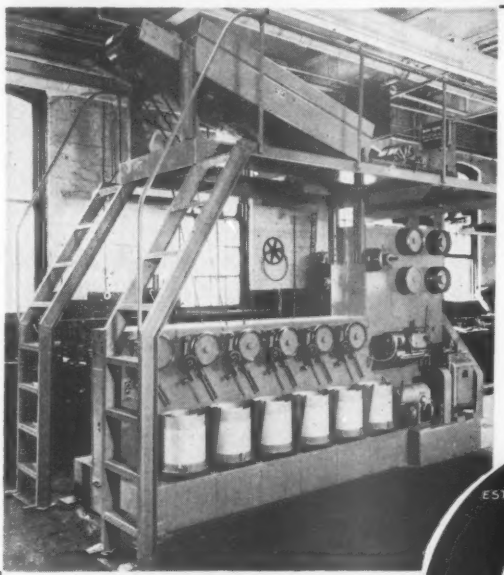

Left: Barrell Take-up No. 1237, B&S Gauge 20 to 30, for enameling machine with pre-annealer.

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Light Nickel Alloy Retort For Wire Anneal Line

(Continued from page 1102)

ings taken from an inside and outside thermocouple several feet inside the entrance show that there is approximately 10-20°C. difference between the readings.

* * *

Readings taken from the exit section of retort where there are two similar burners, show about the same differential. Previously, in order to obtain an internal temperature of 700°C. the external temperature, using the same burners and the same furnace, had to average around 850°C.

* * *

To protect the retort, the outside thermocouple in the stack gas stream over-rides the one on the inside which controls the burners.

* * *

Work annealed in the new retort consists predominantly of brass, bronze, and Everdur**, protected from the outside atmosphere by

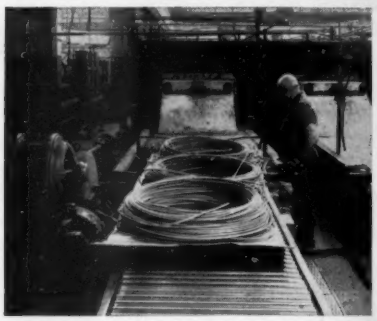

Fig. 3—Retort hood at exit end of furnace is submerged in quench tank. Hot coils entering tank generate steam that fills retort, eliminates air. Note hood is on castors to allow free expansion and contraction; hood at entrance end is similarly mounted.

self-generated steam. Long hoods on either end of the furnace function as heat seals, keeping the steam contained within the retort at a slightly positive pressure. The hoods are securely bolted to the mild steel retort flanges and are supported at the free end by castors that ride with expansion and contraction of the retort during heating and cooling.

* * *

At the exit end of the furnace a tank, with a soapy solution of

* Registered Trade Mark, The International Nickel Company, Inc.

** Registered Trade Mark, American Brass Company.

NEW *from* DYKREX

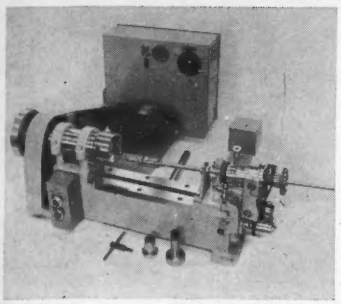

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Fig. 4—Steam, under slight positive pressure, functions as atmosphere during heat treat cycle. New retort is thirty feet long, nine times lighter than previous one, and operates with only 10-20°C. differential between inside and outside temperature.

circulating water, quenches and lubricates the wire for redrawing and also seals it against oxidation. The hood at this end terminates beneath the water level of the quench tank. As the hot coils enter the water they generate the steam that fills the retort and acts as a protective atmosphere. The tank is approximately 15-ft. long and after the coils have been sufficiently quenched they are removed from the conveyor chain by hoist.

* * *

Since installation of the new retort last January it has been in operation 24 hrs. a day, six days a week. During Sunday, the temperature is dropped to 400°C. for quick heat-up on Monday morning.

* * *

There are several additional advantages pointed out by the fabricator, **Rolock, Inc.**, which in time should illustrate some features of the retort that are not now evident. Because there was extra brickwork that had to be completed before the new retort could be put into place, savings in installation time were not readily apparent. Next time the retort is replaced the comparative ease of handling should account for a considerably simpler installation.

* * *

The fabricated construction would also permit alterations of the retort—should any major change in processing at American Brass ever require it. Should any part of the retort fail or become damaged, it can normally be re-

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paired. No pattern was required to produce the retort, so a change in the retort design would not mean a change in pattern—or a new casting pattern.

Sheffield's New Rod Mill

(Continued from page 1104)

minimized in the new mill. If a rod fails to complete its journey through the finishing stands, photoelectric equipment will start automatic operation of the crop and cobble shears. The shears will begin chopping the cobbled rod into short lengths for easy handling. The shearing operation can be started by an operator on the mill before the bar reaches photoelectric signaling devices. Cold ends of bars are also automatically cropped after the bars pass through the intermediate mill.

* * *

At present, the mill will coil rods from .218 to 7/16 inch in diameter. Pouring reels which will be installed this year, will enable the mill to coil from 7/16 to 1⅜ inch rods.

* * *

Main drives of the mill total 11,500 horsepower. However, not all of this power will be utilized at the present time. The mill has been designed to roll skelp and merchant bars and shapes. The reserve power will be needed in the future when facilities are expanded to include these products.

* * *

Every safety precaution known has been taken to protect the mill crew. All moving parts possible have been guarded, screens have been placed over mill housings to confine cobbled rods, and the furnaces have been equipped with automatic cut-off valves.

* * *

Morgan Construction Co., Worcester Mass., is the designer and builder of the mill. Westinghouse Electric Corporation supplied the mill electrical equipment. The general contractor is Rust Engineering Co., Pittsburgh, Pa.

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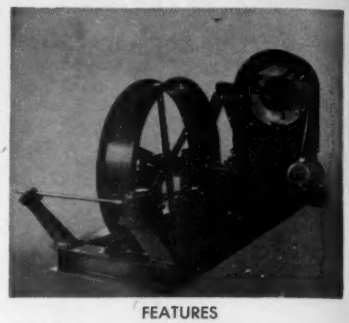

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New Bulletin on Material Handling Pallets and Containers

Tri-State Engineering Company of Washington, Pa., has published a new bulletin, which illustrates and describes the company's complete line of materials handling equipment for industry. Included in the bulletin are illustrations of the various models of Cargotainers, conveyor guard, and pallets produced by the company.

* * *

Of particular interest is a specifications chart, which gives complete information on sizes, weights and capacities of Cargotainers, and serves as a ready reference for materials handling engineers to specify the right container for their requirements.

* * *

Copies of the new bulletin may be secured by writing to Tri-State Engineering Co., 295 W. Beau Street, Washington, Pa.

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Corrosion-Resistant Steel Screws, Bolts and Nuts

(Continued from page 1106)

the embedded screw, will be assured.

* * *

A point worth mentioning is that the method chromising by diffusion of the halide vapours into the surface of the base material readily permits internal threads to be treated. Nuts can therefore be provided with an all-round uniform protective chromised surface. Fig. 3 shows a sectionalised internally threaded chromised bolt and two nuts. Chromised washers are also produced.

Fig. 3—Diffusion-chromised steel screws and nuts. Note that protected zones are similarly produced on the internal threads. * *

Conclusion

Diffusion-chromised screws, bolts and nuts, are produced by the diffusion of chromium into the surface of unalloyed steel screws, bolts and nuts, to create a zone of high corrosion resistance. The chromium is introduced in the form of a vapour of its halides. To achieve optimum results, specially adjusted IK-steels should be used as the base material. These steels, after undergoing an after-treatment, have improved physical properties, so that they are applicable to a wide range of purposes. Practical experience gained in a very wide field has proved the value of diffusion-chromised steel screws, bolts and nuts.

* Ed Note: Deutsche Edelstahlwerke has an American office, namely, Marathon Specialty Steels, Inc., 375 Park Ave., New York 22, N. Y.

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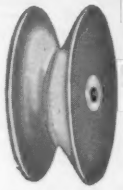

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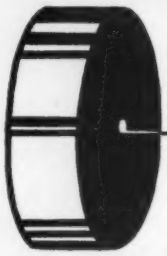

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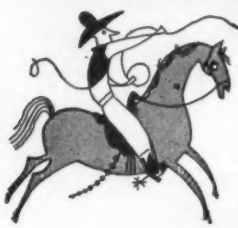

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Dodge Offers Power Transmission Digest

A brief comprehensive review of the Dodge line of power transmission machinery is presented in a new eight-page bulletin.

* * *

Featuring Flexidyne Dry Fluid Drives and Para-flex Flexible Cushion Couplings, two of the newest products in the line, the bulletin also offers illustrated descriptions of such Taper-Lock products as steel conveyor pulleys, roller chain drives, various types of shaft couplings, and the new, compact Dyna-V line of V-belt drives.

* * *

Other products included are Dodge pillow blocks with tapered roller bearings, spherical roller bearings, ball bearings and sleeve bearings, take-ups, friction clutches, Torque-Arm Speed Reducers and Screw Conveyor Drives.

* * *

Ask for Bulletin A-706, **Dodge Manufacturing Corp.**, Mishawaka, Ind.

Effects of Plasticizers Upon Dry Blending Polyvinyl Chloride Resins

(Continued from page 1130)

determining the action of simulated sunlight on the stability of vinyl compounds. It consists, essentially, of a glass enclosed carbon arc about which the test specimens rotate under controlled conditions of temperature and humidity. The value cited refers to the time in hours for the test specimen to develop a strong yellow or deep brown color. (Ambient temperature of 118°F.) The formulation used was:

Exon 915	**100 parts**
DOP	**25 parts**
Plasticizer under evaluation	**25 parts**
Stabilizer, (Ba, Cd, Epoxy, Organic)	**4.5 parts**

* * *

Table IX, Column D: Migration

The value cited is the % loss in weight of a 20 mil calendered sheet while in contact with 100 mesh silicic acid at 30°C. under 10 psi pressure after 25 days. The formulation used was:

Exon 900A	**100 parts**
DOP	**25 parts**
Plasticizer under evaluation	**25 parts**
Co-ppt. Ba-Cd Laurate	**2 parts**
Chelating Agent	**1 part**

REFERENCES

1. **Brown, G. G., "Unit Operations", p. 398, John Wiley & Sons, Inc.**
2. **Brown, G. G., Ibid, p. 77, (1950).**

Wire Kinks

(Continued from page 1115)

If the pipes, rods, wires, pulleys, sheaves, etc., are not equal in diameter, follow this rule. Subtract the smaller from the larger diameter. Divide by 2. Subtract the quotient from the center-to-center distance. The result is the correct measurement to use, edge to edge, as shown by the word RIGHT.

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New Belt Drives on Both Sides

A combination Timing belt and V-belt, that permits the transmission of power with both sides of the belt, has been introduced by **United States Rubber Co.**

* * *

While the theory of dual power transmission belting is not new, since both sides of flat belting have been used for this purpose for years and the use of the backs of V-belts is also common, this is the first type of double-duty belting that enables users to take advantage of a positive drive, non-slip Timing belt that requires no lubrication.

SFK Altoona Plant To Expand

The Altoona, Pa., plant of **SKF Industries, Inc.,** broke ground in May, launching a $4½ million expansion program, announced **E. R. Broden,** president and chairman of the board.

* * *

Scheduled for completion by the end of 1959, the project will make the ball and roller bearing manufacturer's Altoona facility the most modern ball plant in the United States. Employment there will be boosted from 300 to 600 persons, while manufacturing and office areas will increase to nearly 160,000 square feet.

* * *

The company also has two plants in Philadelphia, and one in Shippensburg, Pa., Hornell, N.Y., Massillon, Ohio, and Los Angeles, Calif.

Catalog on Silicone Products

A new, eight-page catalog highlighting the major General Electric silicone products and their uses is now available from the **Silicone Products Dept., General Electric Company,** Waterford, N. Y.

* * *

Among the important silicone uses described are: rubber products, including the new RTV (room temperture vulcanizing) silicone rubber; cosmetics and polishes, electrical insulation, water repellents, textile finishes, lubricants, and release and anti-foam agents.

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Wires and Strands for the fishermen. Trolling Wires, Copper-Monel-Stainless.
Leader Wires, "Wilstabrite" Stainless and "Silverbrite" Music.
Dental and Surgical Wires, large assortment.

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Open hearth grades from low metalloid through high carbon, Thomas grades, cold heading and special grades for sensitive applications. Heavy coils up to 880 lbs.—I.D. up to 33½". Sizes from .200" to ¾".
Reliable delivery schedules at a fair price.

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KURT ORBAN COMPANY, INC.
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Toronto, Montreal, Vancouver

Designated as CDS-129A, this illustrated publication lists additional specialized literature covering product and application information as well as major G-E silicone products.

Schenectady Varnish Appoints Distributor

The appointment of the **Earl B. Beach Company,** Pittsburgh, Pa., as distributors of the complete line of electrical insulating varnishes produced by the **Schenectady Varnish Company, Inc.,** has been announced.

THE Beach Company, which maintains offices and warehouses in Pittsburgh and Philadelphia, will be responsible for the sale of all Schenectady insulating varnishes to electrical maintenance and service shops, replacement coil manufacturers and most original equipment manufacturers in the States of New York, New Jersey, Maryland, Delaware, Virginia, West Virginia and Pennsylvania. Ample stocks of Schenectady's well-known varnishes will be maintained at each warehouse.

POLYETHYLENE & VINYL COLOR CONCENTRATES

FOR COLORING WIRE & CABLE INSULATION AT THE EXTRUDERS

ALL COLORS CONFORM TO N.E.M.A. STANDARDS

The quality is superior both as to color and electrical properties, all colors are sharp and clear, and the dispersions are excellent. This permits a minimum use of the concentrate, lowering costs.

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CENTRAL TOOL AND MACHINE CO.

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Aluminum Coated Wires And Wire Products

ACCO Aluminized Steel Wire and Wire Products — steel core wires for ACRS; steel strang guy wire; overhead ground wire; tie were; messenger wire; telephone wire; chain link fabric and barbed wire — for industrial, institutional and residential uses have been graphically presented in a 6-page folder, DH-537B.

* * *

Issued by the **Page Steel and Wire Division, American Chain & Cable Company, Inc.**, Monessen, Pa., it lists the properties and applications of these widely diversified hot-dip, aluminum coated wires and wire products which combine the strength of steel and the corrosion resistance of aluminum in one end product.

* * *

Reynolds To Up Output

Reynolds Metals Company will boost its primary aluminum output to 93 per cent of the company's annual rated capacity of 601,000 tons, **R. S. Reynolds, Jr.**, president, announced, to meet present market demands for pig and ingot.

* * *

The company is restarting one potline at its Listerhill, Ala., reduction plant and about three-forths of a line at its Jones Mills, Ark. plant, adding 15,000 tons to the annual production rate at each plant. The move reactivates lines that were shut down last September.

Folder On Wire Rope

A new four-page wire rope folder on Wickwire Elevator Cable has been released by **Wickwire Spencer Steel Division** of **The Colorado Fuel and Iron Corporation.**

* * *

Issued to all Wickwire salesmen and available on request from the New York advertising office of the company, the folder describes the need for and uses of Wisscolay Preformed Elevator Cable. It includes information on six strand and eight strand constructions and outlines their proper uses for various elevator applications.

* * *

The back page of the folder includes typical reeving diagrams and wire rope recommendations for "1-to-1 Double Wrap U-Groove Traction Elevators" and "Overhead V-Groove Traction Elevators."

New Tote And Parts Pans

A new line of one-piece, leakproof tote pans and small parts pans in available from **Republic Steel Corporation.**

* * *

The pans provide a practical, economical means of handling, segregating and storing such tool room and shop items as abrasive wheels, brushes, drills and bits, fasteners, small parts and assemblies, and tools of every type.

Drawn from one piece of cold rolled 16-gage steel, the tote pans weigh 8-¾ lbs., are 6-¼ inches deep, and measures 12 x 18 inches top I. D. For easy handling, the tote pans have ½-inch drag-hook holes and a 1-inch curled rim. They come in bundles of five. Other smaller sizes are available.

* * *

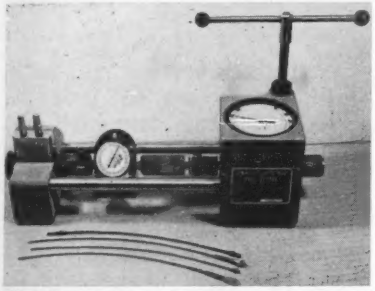
For further information write Republic Steel Corporation, Berger Division, 1038 Belden Avenue, N. E., Canton 5, Ohio.

Force Gauge Checks Accuracy of Cable Terminal Tester

Dillon Force Gauges play a key role in the calibration of portable cable terminal testers manufactured by **Aircraft Tools, Inc.**, of Los Angeles.

* * *

The pull-tester is used in conjunction with this firm's portable swager and is designed to check the safety of swaged terminals on



Dillon Gauge shown in center * * *

aircraft control cables. To meet AN and CAA specifications, the cable terminals, after swaging, must be tested at 60% of the ultimate pull requirement.

* * *

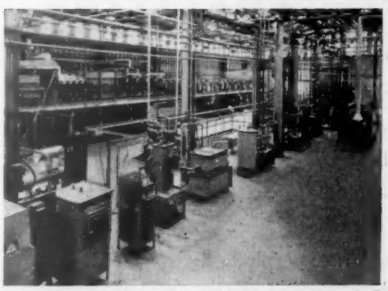
For complete specifications on the Dillon gauge, write to **W. C. Dillon & Co., Inc.**, 14620 Keswick St., Van Nuys, Calif.

EF's New Research Building

The Electric Furnace Company, Salem, Ohio, manufacturers of gas, oil fired, and electrically heated furnaces for continuous or batch heat-treatment of ferrous and nonferrous metals, recently built and opened what is considered the largest and most completely equipped laboratory for research and development work in heat-treatment.

* * *

Through this research laboratory the company conducts tests and experiments to determine temperature, time cycles, and atmospheres best suited for different operations. Matters of furnace design, techniques of brazing, sintering, annealing, normalizing and other heat-treatment problems are being studied, covering every aspect, from furnace materials to effects on metals.



General view of interior of EF's new Research and Development Building. * * * *

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One complete #2 Royle (3½" Screw), 4-Zone Electrically Heated Plastic Extruder, complete with Dual 30" Payoff Stands, Water Trough, Capstan and Dual Takeup with Adjusto Speed Motors, 25 H.P. Reliance Drive. Respooling Equipment; Dual Takeup Stands; and New England Butt 5-wire Upright Twister.

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to Government and Civilian Specifications
Silver Coated Copper and Bronze Wires
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Copper -- Bronze -- Stainless Steel, etc.
WRITE — WIRE — PHONE

THE MONTGOMERY COMPANY
25 CANAL STREET Est. 1871 Tel.: National 3-3336 WINDSOR LOCKS, CONN.

The company has designed the building and its equipment with the idea of keeping its facilities flexible, so that practically any research problem that might arise in connection with heat-treatment may be handled. The facilities are available to metal producers and processors for development and test work conducted in the presence of their own technicians, if desired.

High Density Polyethylene In Telephone Cable

The U.S. Signal Corps has become the first organization to take advantage of the unique properties offered by high density polyethylene for use in telephone cable. **Union Carbide Plastics Company** announced that Bakelite high density polyethylene DGD-4100 was used as insulation for a new type of military telephone cable recently purchased by the Government. This cable meets the requirements of Military Specification MIL-C-55036 which describes an area communications cable containing 26 pairs of individual telephone wires, and is designed for use in a variety of rugged environments. The cable can be used on poles, on the ground where it may be exposed to vehicular traffic, or submerged in water.

* * *

The exceptional toughness and impact strength of Bakelite high density polyethylene compound DGD-4100 offers resistance to physical abuse. The added stiffness of the material enabled the extrusion of thinner walls, resulting in a smaller, more portable telephone cable. The high level of electrical resistivity of DGD-4100 provides excellent resistance to interference and therefore maximum reliability of transmission.

NOTE: Two of the principle wire and cable manufacturers supplying cable under this specification are: Phalo Plastics, Shrewsbury, Mass., and Plastic Wire & Cable Co., Jewitt City, Conn.

THE WIRE ASSOCIATION

invites wire men to join the organization and participate in its activities.

Write for a booklet on what it is and how it functions to

RICHARD E. BROWN
Executive Secretary

453 MAIN STREET STAMFORD, CONN.

Vacuum Pack Protects Wire

A vacuum-polyethylene packaging system for coiled bead wire introduced by **National-Standard Company** has successfully protected wire against corrosion during a six week test of exposure to extremely high humidity.

* * *

William Pace, vice president, said that this test, plus actual field tests in high-humidity atmospheres proves that fabricators can store wire packaged in this manner without rust damage, and maintain inventories to insure continuous production.

* * *

The packaging system uses the reel-less coils of wire developed by National-Standard six years ago. A combination of a vacuum in the polyethylene bag acting as a vapor barrier, plus a dessicant inside the bag keeps the wire dry. Once air is removed from the bag, little water vapor is left inside for the dessicant to absorb.

* * *

As the coils come from final inspection, they are set inside the polyethylene bag, two high on a one-way pallet. The dessicant is inserted and air is withdrawn by a vacuum pump. Corrugated cardboard wrappers are placed around the bagged coils. Coils and cardboard are steel strapped to the pallet, ready for shipment and safe storage.

Issues New Equipment File And Price Guide

In line with its expansion into lines in addition to chemicals for metal finishing, **Allied Research Products, Inc.** has issued a new data file covering its line of process equipment and systems for metal finishing.

* * *

The new file describes the "turnkey" plan for specialized finishing service, as well as specific items of equipment. This service makes available to manufacturers a one-source engineering, installation, and service for complete finishing systems on a "turnkey" basis.

* * *

At the same time, Allied has announced the issuance of its new

"Price Guide" which lists current prices on process chemicals and supplies. Copies of the equipment file and the Price Guide may be obtained by writing to Allied Research Products, Inc.; 4004 East Monument St., Baltimore 5, Md.

Manufacturers' Wire Manuel

This manual is published by **Continental Steel Corporation.** Complete reference for coarse round, standard and special shaped wire, and fine and specialty wire, in many finishes, analyses and tempers in low and medium low carbon steels. Contains packing details for various uses and requirements, including Leverpak drum containers for 500# and 650# catchweight single length coils, and Econo Coils featuring long run 1600# to 3000# catchweight coils. Manual also has complete chemistry of standard steels used for wire, a complete steel wire gauge, various mensuration factors and a table of decimal equivalents. Free copies by writing direct to Continental Steel Corporation, Kokomo, Indiana. The supply is limited.

Technical Bulletin Issued by Holden

A 48-page technical bulletin, published by **The A. F. Holden Co.,** Detroit metallurgists, describes the firm's new luminous wall combustion system for gas-fired, infrared heat treating furnaces.

* * *

Titled "Instantaneous Heat", it sets forth in layman's words the research story behind the luminous wall development, what it is, how it works, its present and future applications, versatility, and a glossary of terms used.

* * *

Also included are numerous drawings and prints, for the metallurgist and heat treating engineer, to substantiate the system's unique claim to rapid starting, rapid cooling, and rapid restarting.

To Head National Electrical Week For 1960

N. J. MacDonald, President, **The Thomas & Betts Company,** Elizabeth, N. J., has been elected chairman of the 1960 National Electrical Week observance, February 7-13, it was announced following the annual meeting of the N.E.W. Industry Committee.

* * *

R. M. Johannesen, Greensboro, N. C., President, Johannesen Electric Company, Inc., was elected vice chairman. Other officers, both of whom were reelected, are: **H. A. Webster,** President, T. Frederick Jackson, Inc., treasurer, and **A. W. Hooper,** Executive Director, National Association of Electrical Distributors, secretary.

* * *

The observance is held annually during the second week in February — the birthday anniversary week of **Thomas A. Edison,** an electrical genius typical of those who helped to create and build today's immense electrical industry.

New Booklet on Use Of Radiation In Industry

A 12-page booklet on the use of x and gamma rays for nondestructive inspection and product testing has been published by **Picker X-Ray Corporation** for industrial firms that make or market any product that needs "looking into" for quality control.

* * *

The booklet, titled "Are You In This Profit Picture?" considers the advantages and disadvantages of both x-radiation and gamma radiation for inspection purposes and answers questions most frequently asked about each.

* * *

Examples of current industrial applications of x-ray and radioisotope machines are given for many manufacturing operations, includ-

BALLOFFET VIANNEY WIRE DIE CO., Inc.

All sizes from .104" down to .0004" in stock

Manufacturers of Quality diamond dies since 1870

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DIAMOND WIRE DRAWING DIES
and DIAMOND POWDER
INDIANA WIRE DIE COMPANY
314-324 E. Wallace St., Fort Wayne, Indiana
Phone: Harrison 4373

ing electric cable and electronic assemblies.

* * *

For a copy, write the company at 25 South Broadway, White Plains, N. Y.

Folder On Space Screens

A four page folder designed to simplify ordering for purchasers of precision space screens is now available from the **Wickwire Spencer Steel Division** of **The Colorado Fuel and Iron Corporation.**

* * *

Titled "Super-Tempered and Wisscoloy Precision Space Screens," the folder describes both types of screen fabric and also offers descriptive information on standard types of hooking available, recommended wire sizes versus openings and standard specifications. In addition, it includes suggested information needed to make a complete, quickly-understood space cloth order.

* * *

The folder is available as a service to space screen users. Free copies may be obtained from any CF&I-Wickwire sales offices.

Techniques of Plant Maintenance and Engineering

The tenth volume in the annual series, "Techniques of Plant Maintenance & Engineering," is, appropriately, the most comprehensive of those published in the past decade. The 1950s saw the beginnings of the new science of maintenance. From a concept of maintenance as a mop and oil-can operation, the science has grown to one of the most important in industry. In the opinion of many, automation may push maintenance into the foremost position of importance in the 1960s.

* * *

The volume, published by **Clapp & Poliak, Inc.,** 341 Madison Av., New York 17, N.Y., is priced at $10 postpaid. It is bound in cloth-on-board, contains 266 pages, each 8½x11", and contains all papers read at the 1959 Plant Maintenance & Engineering Conference held in Cleveland last January.

* * *

One of the major features of the book is the vast number of practical situations it covers. Includ-

DIAMOND DIES
mounted unmounted
For Precision Wire Drawing
BRENON, INC.
Experts in Fine Size Diamond Dies
R.F.D. #2, Box 400, Nixon, N. J.

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SAXL TENSION METERS
Quick Trigger Action
For Wire Drawing, Insulating, Enameling and Coil Winding
American made and serviced, always reliable
TENSITRON, INC., Harvard, Mass. Patented

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AND EQUIPMENT
Rod Frames — 16" Frames, 8" Frames — Take-Up Frame, Wire — Pointers — Pulley Tongs — General and heat resisting alloy castings for wire mill use.
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WIRE WORKING MACHINERY
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U. S. Tool Co. No. 22, 28, & 33 Multislides
Sleeper & Hartley Spring Coilers Nos. 0, 1, 2, 3, 3½, 4, & 5 & Torrington W10 & W12
Vaughn No. 8, 10, & 12 Moto-Blocs
Waterbury No. 3 Bull Blocks, Duplex
Morgan 4 stand Wire Drawer with pointer and 100 H.P. motor drive & motor
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STANDARD OIL BLDG. BALTIMORE 2, MD.

ed are answers to 1,056 questions submitted by engineers attending the conference. More than 70 charts, graphs and diagrams are reproduced.

To Distribute Carboloy Products

Appointment of **Abrasives & Tools, Inc.**, Auburn, Mass., **E. C. Blackstone Co.**, Memphis, Tenn., and Joplin Supply Co., Joplin, Mo., as authorized distributors of Carboloy cemented carbide products has been made by the Metallurgical Products Department of the **General Electric Company**, Detroit. The concerns will stock Carboloy toolholders, blanks, wheel dressers, masonry drills and carbide tools.

* * *

Abrasives & Tools from 469 Southbridge St., Auburn, will cover Worcester County and the states of Vermont and New Hampshire. Joplin Supply, located at 3rd and Joplin Sts., will serve sections of Missouri, Oklahoma, Kansas and Arkansas. Blackstone, at 600 Madison Ave., Memphis, works in Tennessee, Mississippi, Alabama and parts of Missouri.

Cleveland Carboloy Offices Moved

The Cleveland office of **General Electric Company's Metallurgical Products Department** was moved June 29 to 130 Northfield Road, Bedford, Ohio. Present address is 4707 Euclid Ave., Cleveland.

* * *

The Cleveland office is headquarters for 5 states, including parts of Kentucky, Pennsylvania, New York, Ohio, West Virginia. Larger

Metallurgical Engineer for high carbon wire mill. Minimum three year's experience. Work involves manufacturing processes, problems and product responsibility. Will be in direct charge of junior engineer. Address J. A. Turner, John A Roebling's Sons Division, The Colorado Fuel and Iron Corporation, 640 So. Broad St., Trenton 2, N. J., giving age, experience, education and salary requirements.

FOR SALE
12-24 carrier Wardwell braiders.
21-24 carrier N. E. Butt braiders.
20-16 carrier N. E. Butt braiders.
4 Univ. #50 tube winders 6-Ga.
WE BUY YOUR SURPLUS
Michael Solomon Company
131 Spring St., N. Y. C. WOrth 6-5449

FOR SALE
Fifty H.P. Waterbury- Farrel Rolling Mill, 10"x10" rolls: Ten H.P. take-up with 22" drum four foot long. Flattened 3/16" x 5/8" from 29/64" Rods.
Reply to Box 997
WIRE & WIRE PRODUCTS
453 Main Street Stamford, Conn.

FINE and MEDIUM SIZE WIRE
TAKE-UPS
8, 10, & 12 SPINDLES
COLBOURNE MACHINE COMPANY
21 MUNRO ST. • WINSTED, CONN.

quarters more centrally located in the metalworking industry is the reason for the move. The General Electric unit, headquartered in Detroit, manufactures Carboloy cemented carbides.

Specification Chart of Screw Threads

Of interest to Engineers, Inspectors and Purchasing Agents is a wall or desk chart showing all details for Unified and American External Screw Threads with diagrams showing the terms for ordering.

* * *

All specifications (0.060" thru 1.0" as well as Thread Symbol, Allowance, Max and Min diameters, Max and Min Pitch Diameters, etc., are all on the one card. Figures large and readable.

* * *

The chart is a big timesaver as correct sizes, etc. can now be specified on prints and requests for quotations. It will be mailed free to any one requesting same on company letterhead from **The Ohio Rod Products Co.**, 20259 First Ave., Berea, Ohio.

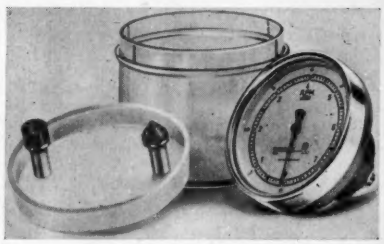
Correction Notice

At the bottom of the third column of page 964 in Mr. Osterer's article on "High Frequency Resistance Annealing of Wire," the last two lines belong in another article. These should appear at the bottom of the third column on page 1028 of Mr. Humphrey's paper on the "Impact of Equipment in the Industrial Fastener Field."

— Remember —
OCTOBER 12 - 15, 1959
STATLER HILTON HOTEL
Cleveland, Ohio
for
THE WIRE ASSOCIATION'S ANNUAL CONVENTION

Announces New Tachometer

Boulin Instrument Corporation, 10 First St., Pelham, N. Y., announces the addition of a group of Eddy-Current Hand Tachometers to its present line of speed measuring instruments to be known as the "Magna Tak." Manufactured in Western Germany, these small, light weight, inexpensive instruments are designed with rugged simplicity without sacrifice of accuracy.



The following features make this line of tachometers attractive to most users:

1. Accuracy ± 1.0%
2. Indicates direction of rotation.
3. Weighs less than 9 ounces.
4. Spindle is mounted in sealed ball bearings.
5. Only two moving parts.
6. Available in four speed ranges:
   - 0 - 2000 RPM
   - 0 - 4000 RPM
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Address application, with resume to:

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Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Norton Co., Worcester, Mass.

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(See Inhibitors, Pickling)

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Syncro Machine Co., Perth Amboy, N. J.

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Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

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(See OVENS—Rod Bakers)

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Acrometal Products, Inc., Minneapolis, Minn.
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Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
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BORAX—Wire Drawing
United States Borax & Chemical Corp., Pacific Coast Borax Co. Div., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

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Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

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Bartell Machine Tool Corp., Rome, N. Y.
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Blane Corporation, The, Canton, Mass.
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Blane Corporation, The, Canton, Mass.
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U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.

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CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

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Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
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CORDS—Electrical, Tinsel Conductor
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COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

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CUTTING TOOLS—Wire
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Robinson, M. W. Co., Rockville, Conn.

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Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

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Wayne Wire Die Co., Linden, N. J.

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Kelloy Corporation, New York, N. Y.
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Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
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Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
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Rivom, Dijon, France

DIES—Diamond
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Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

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DIES DIAMOND—Reversible
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National Wire Die Co., Inc., New York, N. Y.

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Central Tool and Machine Co., Bridgeport, Conn.
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Rivom, Dijon, France.
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Wayne Wire Die Co., Linden, N. J.

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Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

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Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.

Eastern Carbide Corp., New Rochelle, N. Y.
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DIES—Roll Threading
Rivom, Dijon, France

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Rivom, Dijon, France

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tinning
Roux Wire Die Works, Inc., Oriskany, N. Y.

DIES—Tube Drawing
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Eastern Carbide Corp., New Rochelle, N. Y.
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Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY)—Draw Benches)

DRUMS—Wire Packaging
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Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

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Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio.

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A. Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.
Harper Electric Furnace Corporation, Buffalo, N. Y.
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Galvanizing Equipment
Sunbeam Equipment Corporation, Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Harper Electric Furnace Corporation, Buffalo, N. Y.
Ofenbau Fritz, G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Sunbeam Equipment Corporation, Meadville, Pa.
Wilson Lee Engr. Co., Cleveland, Ohio

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Ajax Electric Company, Philadelphia, Pa.
Ofenbau Fritz, G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Resistance Heating, Strand
Harper Electric Furnace Corporation, Buffalo, N. Y.
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.

FURNACES—Strand Annealing
Ajax Electric Company, Philadelphia, Pa.
Harper Electric Furnace Corporation, Buffalo, N. Y.
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Sunbeam Equipment Corporation, Meadville, Pa.

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

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Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

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Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
Amchem Products Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS—
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
General Tire & Rubber Company, The, Akron, Ohio.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

LACQUERING SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The, Philadelphia and Bellefonte, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Company, Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Takemura & Co., Ltd., New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Bobbin Winders
Hanson & Edwards, Ltd., Warrington, England
Larmuth and Bulmer, Limited, Manchester, England

MACHINERY—Bolt, Rivet, Screw, etc.
Behr Machinery & Equipment Corp., Rockford, Ill.
Takemura & Co., Ltd., New York, N. Y.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Larmuth and Bulmer, Limited, Manchester, England
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Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Vaughn Machinery Co., Cuyahoga Falls, Ohio

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
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Larmuth and Bulmer, Limited, Manchester, England
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Syncro Machine Co., Perth Amboy, N. J.
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MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corporation, New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Steel & Wire Machinery Co., Cleveland, Ohio

MACHINERY—Chain Making
Larmuth and Bulmer, Limited, Manchester, England
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MACHINERY—Closing Cable
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
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Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N.J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
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MACHINERY—Cold Heading
Behr Machinery & Equipment Corp., Rockford, Ill.
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MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
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Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Pan American Supply Company, New York, N. Y.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Company, Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Maschinenfabrik, Herborn, Germany
Pangborn Corporation, Hagerstown, Md.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Diameter Control
Daystrom-Weston, Industrial Gauges, West Englewood, N. J.

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Wayne Wire Die Co., Linden, N. J.

MACHINERY—Draw Benches
American Laubscher Corporation, New York, N. Y.
General Machine Tool Co., Worcester, Mass.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Edging (See MACHINERY—Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Royle, John, & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Wafios Machinery Corp., Hackensask, N. J.

MACHINERY—Flat Wire
General Machine Tool Co., Worcester, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Stanat Manufacturing Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio
Steel & Wire Machinery Co., Cleveland, Ohio

MACHINERY—Forming Wire
Steel & Wire Machinery Co., Cleveland, Ohio
Takemura Co., Ltd., New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Galvanizing Wire
Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Steel & Wire Machinery Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulation Testing (See MACHINERY—Spark Testing)

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia, Pa.
Cook Mfg. Co., The, Paterson, N. J.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
EVG., Machinen & Stahl, A. G., Zurich, Switzerland

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Diam., Insulated Wire
Daystrom-Weston, Industrial Gauges, West Englewood, N. J.

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wisc.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providene, R. I.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Packaging Wire
Advanced Wyrepak Co., Inc., Bridgeport, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Paper Clips
Pan American Supply Company, New York, N. Y.

MACHINERY—Patenting Wire
Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Pin Making
Takemura & Co., Ltd., New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Plating
Bartell Machine Tool Corp., Rome, N. Y.
Hodge Bros. Machine Shop, Ossining, N. Y.
Universal Industries Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Printing on Electric Wire
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M. Co., Inc., West Boylston, Mass.

MACHINERY—Re-Spooling
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Emory Company, Robert J., Newark, N. J.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
General Machine Tool Co., Worcester, Mass.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
National Mach'y Exch. (Used), New York, N. Y.
Vaughn Machinery Co., Cuyahoga Fall, Ohio
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Ring Forming
Pan American Supply Company, New York, N. Y.

MACHINERY—Rod Mill
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So San Francisco, Calif.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Mills
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Peschel Electronics, Inc., Towners, N. Y.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Special
General Machine Tool Co., Worcester, Mass.

MACHINERY—Spooling Tension Controls
Web Controls Corp., West Englewood, N. J.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Staple Making
Pan American Supply Company, New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Straightening & Cutting
American Laubscher Corporation, New York, N. Y.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
George C. Patterson Machine Co., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Steel & Wire Machinery Co., Cleveland, Ohio
Takemura Co., Ltd., New York, N. Y.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Bartell Machine Tool Corp., Rome, N. Y.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth & Bulmer Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
Advanced Wyrepak Co., Inc., Bridgeport, Conn.
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth & Bulmer Limited, Manchester, England
Litzler, C. A., Co., Inc., Cleveland, Ohio
Pourtier Pere et Fils, Romainville (Seine) France
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Mach'y Div., Pawtucket, R. I.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine) France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Mach'y Div., Pawtucket, R. I.
Cook Manufacturing Co., The, Paterson, N. J.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.

Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, Ohio

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Collins Bros. Machine Co., Wire & Cable Mach'y Div., Pawtucket, R. I.
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Welded Wire Mesh
E. V. G., Maschinen and Stahl, A.G., Zurich, Switzerland
Schlatter, Ltd., H. A., Zollikon/Zurich

MACHINERY—Wire Weaving
Takemura & Co., Ltd., New York, N. Y.

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Enjaco Corporation, Cranston, R. I.
General Machine Tool Co., Worcester, Mass.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York, N. Y.
Atlas Polar Co., Ltd., Toronto, Ont., Canada
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Showa Machine Works Ltd., Osaka, Japan
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Wire and Machinery Co., Cleveland, Ohio
Superior Tool & Machinery Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Takemura Co., Ltd., New York, N. Y.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wire Machinery Inc., Chicago, Ill.

MACHINERY—Wire Forming
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Takemura Co., Ltd., New York, N. Y.

MACHINERY—Wire Rope
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
American Laubscher Corp., New York, N. Y.
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Company, Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio

NAIL TOOLING—Tungsten Carbide
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Central Tool and Machine Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Company, Winsted, Conn.
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAINT BONDING CHEMICAL
Amchem Products, Inc., Ambler, Pa.

PAINTS—Heat Resisting
Amchem Products, Inc., Ambler, Pa.

PAPER—Insulating
Twitchell, Inc., E. W., Philadelphia, Pa.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Cary Chemicals, Inc., New Brunswick, N. J.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

PLASTICS—for Wire Insulation
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

PRINTING WHEELS—for Electric Wire
Daniels & Co., Frank, New York, N. Y.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M. Co., Inc., West Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Mettler Machine Tool, Inc., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett ,Ind.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pull Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wood's Sons Company, T. B., Chambersburg, Pa.

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Seymour & Peck Div., The Grief Bros. Cooperage Corp., Chicago, Ill.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
New York Engineering Corp., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Steel, for Rope and Cable
New York Engineering Corp., Yonkers, N. Y.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Boonton Molding Company, Boonton, N. J.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Herculean Reel Company, Rusk, Texas
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Molded Fiber Glass Tray Co., Linesville, Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Seymour & Peck Div., The Greif Bros, Cooperage Corp., Chicago, Ill.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Herculean Reel Company, Rusk, Texas
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

REFRACTIONS—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Pittsburgh Steel Co., Pittsburgh, Pa.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio

ROLLS—For Flattening Wire
General Machine Tool Co., Worcester, Mass.

ROPE—Wire
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons, Div. Colorado Fuel & Iron Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SATURATION SYSTEMS—
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—Plastic
Boonton Molding Company, Boonton, N. J.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Molded Fiber Glass Tray Co., Linesville, Pa.
Plastic Mold & Engineering Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.

Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS
Jarke Manufacturing Co., Chicago, Illinois

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, Ohio

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, W.-Germany)

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TENSION METERS—for Wire
Boulin Instrument Corporation, Pelham, N. Y.

TESTERS—INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT — Dielectric Faults in Insulation
Peschel Electronics, Inc., Towers, N. Y.

TESTING EQUIPMENT — Physical
Scott Testers, Inc., Providence, R. I.

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

TRANSMISSIONS—Variable speed (See Adjustible Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Hodge Bros. Machine Shop, Ossining, N. Y.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Insulating Materials Section, Schenectady, N. Y.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WAXES—for Insulated Wire
Cary Chemicals, Inc., New Brunswick, N. J.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
E. V. G., Maschinen and Stahl, A. G., Zurich, Switzerland
Micro Products Co., Chicago, Ill.
H. A. Schlatter, Ltd., Zollikon-Zurich

WHEELS—for Printing on Electric Wire
Daniels & Co., Frank, New York, N. Y.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

WIRE—Aluminum
Malin & Co., The, Cleveland, Ohio
Scovill Mfg Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Malin & Co., The, Cleveland, Ohio
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Bunched and Stranded
Camden Wire Company, Camden, N. Y.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, Ohio

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio

WIRE—Copper
Camden Wire Company, Camden, N. Y.
Malin & Co., The, Cleveland, Ohio
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
Camden Wire Company, Camden, N. Y.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Jones & Laughlin Steel Corp, Stainless and Strip Div., Detroit, Mich.
Montgomery Co., The, Windsor Locks, Conn.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado, Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corporation, Pressed Steel Div., Cleveland, Ohio
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio

WIRE—Metalizing
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Platt Bros & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio

WIRE—Needle
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Special Shapes
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
National Lock Washer Company, The, Newark, N. J.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio

WIRE—Stainless Steel
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Malin & Co., The, Cleveland, Ohio
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester Mass.
Jones & Laughlin Steel Corporation, Pittsburgh Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Zinc
Blatt Bros. & Co., The Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

YARNS—Wire Insulating
Synthetic Thread Co., Bethlehem, Pa.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

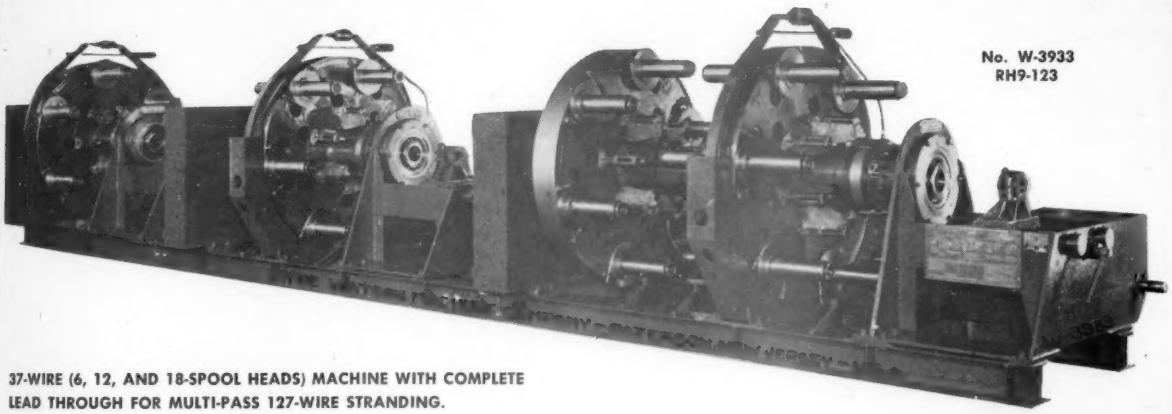
ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

WATSON

STRANDING HEADS TYPE "RH9"

THIS RIGID FRAME HORIZONTAL DESIGN IS THE INDUSTRY'S PREFERRED MEDIUM FOR PRODUCING SOFT COPPER AND ALUMINUM MULTIPLE-LAYER CONCENTRIC STRAND OF ROUND OR SECTOR SHAPE.

THE RH9 HEADS CARRY STEEL SPOOLS 22" FLANGE DIAMETER x 11" TRAVERSE x 5" DIAMETER BORE, OF 650-POUND COPPER WIRE CAPACITY.



No. W-3933
RH9-123

37-WIRE (6, 12, AND 18-SPOOL HEADS) MACHINE WITH COMPLETE LEAD THROUGH FOR MULTI-PASS 127-WIRE STRANDING.

WHEN COMPARED WITH PLANETARY MACHINES OF SIMILAR UTILITY, THE FOLLOWING ADVANTAGES ARE NOTEWORTHY: MUCH LOWER INITIAL COST, LESS FLOOR AREA REQUIRED, CONSIDERABLY HIGHER SPEEDS, GREATLY REDUCED LOADING TIME, LESS POWER REQUIRED, FEWER OPERATORS REQUIRED, AND MAINTENANCE IS PRACTICALLY NIL.

OPEN DESIGN, WITH OVERHUNG SPINDLE MOUNT, ALLOWS UTMOST FREEDOM AND RAPIDITY OF LOADING AND THREADING. ALL STEEL AND BALL BEARING THROUGHOUT. FULLY ENCLOSED AND FORCE-FEED LUBRICATED DRIVE AND CHANGE GEARING. AUTOMATIC ELECTRIC STOPS FURNISHED. SPRING-SET AIR-RELEASED BRAKES.

ROLL-OVER EQUIPMENT ON HEADS FOR PRE-SPIRALED (PREFORMED) SECTOR STRANDS PROVIDED WHEN SPECIFIED.

COMPLETE LEAD-THROUGH FOR MULTI-PASS STRANDING AND TANDEM ARRANGEMENT INSTALLED WHEN REQUIRED.

THIS DESIGN IS ALSO AVAILABLE IN SMALLER SIZES AND GROUPING, WITH AUXILIARIES TO MEET ANY PRACTICAL RIGID FRAME STRANDING REQUIREMENT.

9-59

new Continucoil*... a high speed take-up system for continuous wire drawing and annealing equipment

Syncro CONTINUCOIL model SGD-1, a new continuous coiling system for copper wire, removes, for the first time, previous coiling speed restrictions and production shutdowns. Specially arranged wire guides, an accumulator, and a non-rotating collecting drum permit continuous operations at speeds up to 4000 fpm. The collecting drums are designed for both in-plant use or shipping the ready-packed wire. CONTINUCOIL meets the high speed requirements demanded by modern continuous wire drawing and annealing equipment.

†Lower speed CONTINUCOIL units also available for tinning, extruding, and other applications.

Our experienced staff welcomes the chance to give you further information on how CONTINUCOIL can help meet your specific coiling requirements. Write Syncro Machine Company, Department C, Perth Amboy, N.J.

THE MEASURE OF SUPERIOR DESIGN

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Affiliated company: WINGET SYNCRO Ltd. Rochester, Kent, Eng

Better Machinery for the Wire Indust

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